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Editorial note:
The authors of this paper have asked to have their names withheld. The JPN editorial team do not usually agree to such requests, but we have made an exception in this case. As you will read, there is significant animosity between Nurse Practitioners and the federal health bureaucracy. Real or otherwise, the authors fear potential reprisals for calling out what they see as prejudicial behaviour against their community.

The good, the bad and the ugly: Nurse Practitioners and the politics of health care

The good

Nurse Practitioners (NPs) are highly educated health care professionals and the only advanced practice nurses recognised and regulated by the Nursing and Midwifery Board of Australia. The purpose of implementing the NP role was to improve the flexibility of the Australian health care system and increase patient access to health care[1]. The endorsement of the first two Australian NPs took place in December 2000, and now over 2200[2] NPs provide comprehensive patient care across a diverse range of health care continuums[3,4]. Through collaborative, safe, and effective care, the NP provides value-based health care across the public and private health care sectors[5].

In 2009, then Minister for Health Nicola Roxon, led historic health reform resulting in the *Health Legislation Amendment (Midwives and Nurse Practitioners) Act 2010*. This legislation enabled patient access, albeit limited, to the Medical Benefits Schedule (MBS) and the Pharmaceutical Benefits Schedule (PBS) for eligible NPs[6]. As a result, private patients choosing to see an NP for their health care can claim limited Medicare subsidies for services and medicines arising from NP-directed care in primary health care settings.

The MBS and PBS reforms have truly been transformative for the Australian NP role. No longer restricted by often rigid public sector NP models of care, that limit nursing scope of practice and innovation[7–9], NPs are increasingly moving to the private sector to actualise the full potential of their roles and explore innovative models of care[10].

The bad

More than a decade later, of the 5700 items listed on the MBS, patients are still limited to a handful of subsidies for NP-directed care[11]. These include subsidies for face-to-face and telehealth consultations, a comprehensive array of diagnostic pathology items, limited diagnostic imaging requests and limited point-of-care tests performed by NPs[11]. Evidence suggests NPs often achieve the same or better outcomes in delivering primary care services compared to doctors[12,13]. Despite this, the Australian government uses taxpayer dollars to increase subsidies for patients seeking care from doctors, thereby giving the medical profession an unfair market advantage over NPs providing those same services. After ten years of participation in the MBS and PBS, there is no evidence that suggests services performed by NPs are inferior, unsafe or ineffective when compared to doctors. One has to ask why the Australian Department of Health (DoH) refuses to broaden the scope of subsidised services offered by NPs. The answer may lie in the lobbying influence of medical associations influencing DoH bureaucrats to assist with turf protection for the financial benefit of doctors and not the benefit of patients[14].

When looking at consultations alone, MBS subsidies are over 50 per cent higher for general practitioners, who are also afforded additional

incentives for 'bulk billing' their patients. Bulk billing transfers the patient's subsidy directly to the health practitioner. No special incentives exist for NPs who bulk bill their patients. Such Australian government policies assure that only the medical profession can provide universal health care through bulk-billed MBS services. The existing MBS subsidies ensure that bulk-billing NPs can neither sustain themselves financially nor practise independently. To maintain financial viability, NPs are increasingly passing the costs of care provision onto patients. In effect, the Australian DoH is consciously shifting health expenses to the consumer regarding NP-related primary health care, as it is nearly impossible for NPs to earn a living on a bulk-billed income alone.

Current MBS subsidies limit patient access to health care and, for some patients, remove the choice of who delivers their health care. Attempts by NPs to change the limited access to the MBS include 14 evidence-informed primary health care recommendations compiled by the Nurse Practitioner Reference Group (NPRG)[15] for the MBS Review. There were also numerous professional body and individual clinician submissions to the MBS Review. In their capacity as representatives of peak professional bodies, NPs and many other nursing leaders met many times with government to lobby for broadening MBS subsidies to address crucial health care shortfalls. All of these attempts have been unsuccessful[16]. Of note, the membership of the MBS Review Taskforce had no representation from the nursing profession and consisted almost entirely of medical practitioners, except for one policy expert and one health consumer. Medical associations representing medical practitioners have clearly articulated their position on the NP role. These positions are not supported with evidence but with the use of misinformation and scare tactics[17–19]. Compounding this situation are press releases outlining how the Australian government and medical associations are working together to co-design administrative processes to support future changes to the MBS, which leaves little confidence that the patients of NPs will receive fair subsidies[20].

The experience of NP surgical assistants also demonstrates the notion of a medico-centric approach to administering the MBS by the Australian DoH. Aside from input into the MBS Review process, the NP surgical assistants have unsuccessfully tried to navigate the Medical Services Advisory Committee (MSAC) process. The role of MSAC is to appraise health care services for public funding[21]. NP surgical assistants have demonstrated they offer an effective[22] and legitimate[23] alternative to medically qualified surgical assistants and increase patient access to surgical care[24]. Yet, attempts to gain access to the MBS surgical assisting patient rebates via applications to the MSAC committee have failed. Both applications failed in the pre-assessment phase. Like the MBS Review Taskforce, the MSAC committee has no nursing representation, with 16 of the current 21 positions occupied by medical practitioners.

At face value, the above observations appear anti-competitive in nature. This proposed anti-competitive culture of the Australian DoH makes one wonder if the *Competition and Consumer Act 2010* applies, or if the powers of the Australian Competition and Consumer Commission (ACCC), the independent statutory authority that enforces the Act, pertain to those administering the MBS. The ACCC is investigating if the Australian DoH has a case to answer. The ACCC has also suggested that the Commonwealth Ombudsman may be an alternative avenue for NPs to consider. The role of the Commonwealth Ombudsman is to assure that Australian Government entities act with integrity, treat people fairly and influence improvements in public administration[25].

The ugly

Failing meaningful intervention from the ACCC or the Commonwealth Ombudsman, the law of torts may be a final possibility. Torts law is concerned with awarding damages to individuals to repair the harm caused by a breach of obligation[26,27]. The tort of misfeasance applies to a person occupying a public office who exceeds or abuses public power[28] or breaches their obligations[27]. Two points for consideration here are:

1. that occupancy of public office implies a public position, but this is not limited to those appointed to a statutory office; there is no definitive test to determine what incorporates public office
2. the notion of public law obligation considers public officials owe a duty of care not to abuse their powers[29].

Misfeasance is 'the wrongful performance of a normally lawful act; the wrongful and injurious exercise of lawful authority'[30]. This tort does not apply to everyone employed by a public authority; the courts have outlined that the public official must have a significant position with relevant power and accountability to the plantiff[27]. To establish the tort of misfeasance, the plaintiff must prove that in the alleged discharge of the public official's duty, their act was invalid or unauthorised, malicious and caused harm to the plantiff[31].

The MBS Review Taskforce aimed to align the MBS with contemporary clinical evidence and practice by providing recommendations for reform to the Minister for Health. The aims were to support affordable and universal access, best-practice health services, value for the individual patient and value for the health care system[15]. The MBS Review Taskforce did not endorse any recommendations from the NPRG but did propose three 'alternative' recommendations without any evidence or rationale to support them. This action was outside the MBS Review's terms of reference and highlighted not only poor Australian DoH governance processes but also the genuinely medico-centric nature of the MBS Review process.

Members of the MBS Review Taskforce were in significant positions of power and had accountability to patients and NPs, not solely medical practitioners. The taskforce was predominately comprised of medical practitioners engaged by a medico-centric DoH.

Members of the taskforce had many opportunities to discuss and engage with NPs and nursing groups, who highlighted the importance of both comprehensive MBS access for patient care and reduced out-of-pocket expenses. The failure of the taskforce members to recognise these highly skilled health care professionals and ignore the evidence they provided has impacted many NPs' mental health. Their primary source of distress relates to their patients who, due to the current MBS restrictions, cannot access subsidised health care and have sometimes experienced unacceptable delays or duplication in care that has contributed to patient harm, as well as breaches in patient confidentiality. Disregarding NPRG recommendations and proposing irrelevant substitute recommendations, knowing these would restrict the NPs ability to provide patient care, may enable action in misfeasance against taskforce members.

Finally, one should note there may be unintended consequences to the staunch resistance of the medical lobby to patient subsidies for NP-directed care. Medical turf protection and non-collaboration may ultimately result in a parallel system of primary health care providers, who actively compete for the patients and businesses of high-paying health consumers. This can be seen with NPs who are turning to niche specialty practices funded solely by out-of-pocket payments because they can't earn a living serving the marginalised populations they were educated and trained to care for. This serves no one, with losers on both sides.

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The first three procedures that marked the dawn of surgery

Abstract

Archeological studies reveal that humans splinted fractures and operated on skulls. Other than dealing with wounds or fractures, early surgeons carried out three types of operative procedures – circumcision, trephination and lithotomy. The first two procedures are the most ancient, for it is hypothesised they were undertaken between 10 000 and 15 000 years ago. Circumcision was a religious, fertility or initiation rite or ritual and trephination was done for mystical as well as therapeutic purposes. In contrast, lithotomy commenced much later, between the 4th and 5th centuries BCE and therefore did not occur prehistorically. However, it is the first operation that was performed to relieve a specific surgical condition.

Introduction

An earlier paper[1] published in JPN outlined the beginnings of perioperative nursing, which had its genesis in surgical nursing about 150 years ago. This exploration of nursing's first specialisation prompted reflection on the history of surgery, a craft whose pedigree stretches back to the dawn of humankind. This paper does not intend to provide even the briefest outline of this history, for it is not possible in such a small compass. Instead, the focus is on the three earliest known 'elective' interventions that date back many thousands of years and which are still performed today.

The word 'surgery' is derived, via the Latin *chirurgia*, from the ancient Greek *χειρουργία* (kheirourgia) and means hand work[2]. Our innate instinct for self-preservation no doubt drove us to seek help if we couldn't help ourselves. As far back as, possibly, a quarter of a million years ago, our prehistoric ancestors were being treated for injuries and diseases by primitive 'healers', those among our forebears who had a particular aptitude to carry out such activities[3]. Clearly, these treatments occurred long before the advent of the written record, that is, in prehistoric times. The term is mostly used for the period from 12 000 before the common era (BCE) to 3000 BCE – roughly speaking, the Neolithic age. Our understanding of events of that time is derived from archaeology and its associated study of tools, bones, buildings and cave drawings.

Archaeological excavations revealed ancient skeletons that had sustained fractures (caused by accidents, falls and animal or human attacks) and showed evidence of bone disease, even rotten teeth[3]. It is hypothesised that injuries were variously treated and dressed, based on the early studies of primitive tribes from the beginning of the 20th century[4]. Australian Aborigines encased broken arms in clay, which hardened in the sun, and covered cuts with animal fat then bound them up with bark or animal skin[4].

Elsewhere around the globe, primitive tribes used leaves and plants, cobwebs (which may well have some blood clotting properties), ashes and even cow dung on open wounds[3]. More robust evidence of broken limbs being splinted and of wounds being dressed with lint date from about 2450 BCE and came from Egyptian excavations[3].

However, the management of these broken limbs or open wounds is not under scrutiny here, as noted earlier. Instead, it is the work of those early 'surgeons' who carried out three types of operative intervention – circumcision, trephination and lithotomy[3,5,6]. Although circumcision is thought to be the most ancient of the three, there is some evidence that trephination was practised at least as early and possibly earlier[3]. It begs the question, why were these procedures performed?

Circumcision

Anthropologists cannot agree on the origins of circumcision (removal of some of the foreskin, or prepuce, from the penis[7]), nor how long it has been in existence, perhaps because the practice has occurred in such geographically disparate regions around the globe. It has been suggested that it is one of the features of a 'heliolithic' culture which, over 15 000 years ago, spread over much of the world[7].

Circumcision has been practised among primitive communities in Australia, South America, the South Pacific, equatorial Africa, Turkey, Egypt and the Middle East. It is known to have been practised by priests' assistants on the priests and members of royal families in Egypt between 2400 and 3000 BCE[3]. A bas relief from the sixth dynasty (4300 years ago) on the sarcophagus of Ankh-ma-Hor at Saqqara shows male circumcision being practised on two boys or young men as a ritual prior to entry into the priesthood (Figure 1). In it, a crude stone instrument is employed by the operators and the inscription has them saying, 'hold him so that he may not faint' and 'it is for your benefit'.

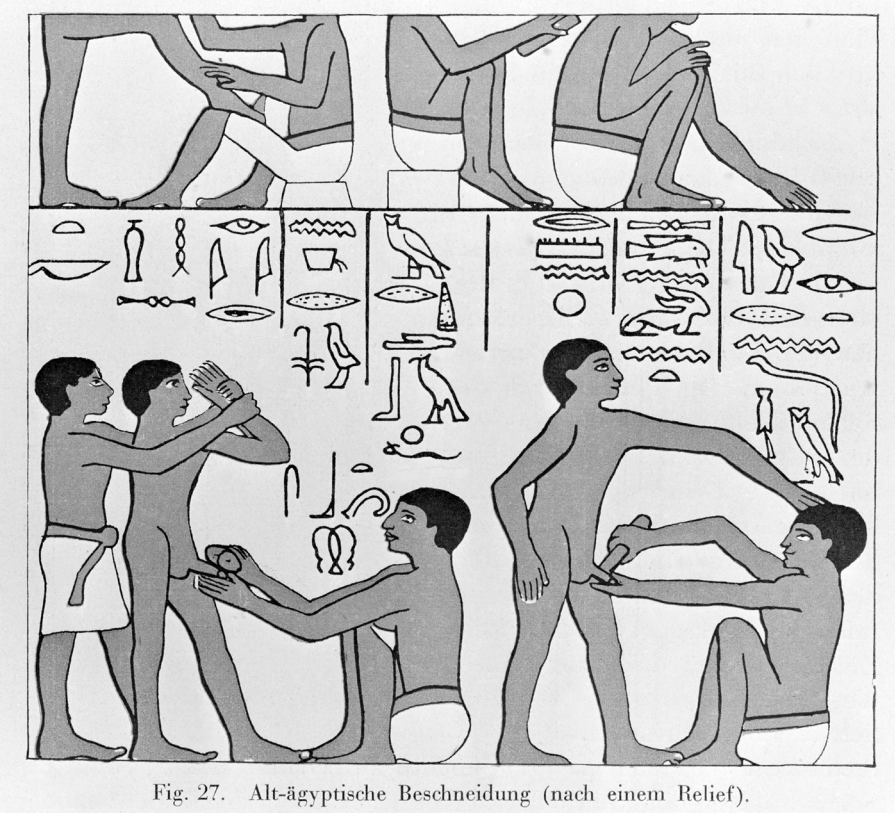

Figure 1: Figures showing a circumcision

(Source: Wellcome Collection Gallery. This file comes from Wellcome Images, a website operated by Wellcome Trust, a global charitable foundation based in the United Kingdom. Refer to Wellcome blog post (archive).)

In some African tribes it was performed at birth; in Judaic societies, male circumcision is linked to a covenant with God dating back to Abraham[8] and is completed on the eighth day after birth. Among Moslem peoples of India and Southeast Asia, and other tribal cultures, it occurred in early adult life as a rite of passage[7].

It has also been practised as a form of punishment inflicted upon those who were not circumcised, sometimes during battle; in Koranic times, the slashed prepuces of 'unbelievers', collected following a battle, were held up as trophies of victory[8].

Other reasons proffered for undertaking circumcision include:

- as a fertility rite[7]
- to maintain hygiene and cleanliness[3]
- as a form of social control[8]
- as a form of cultural identity[7]
- as a sacrifice to the gods[7]
- as a mark of defilement or slavery[7]
- to dampen sexual desire and limit sexual intercourse[9].

Techniques and practitioners of the 'procedure' were diverse. In biblical times, the mother performed the circumcision but over time it largely fell within the remit of religious men. In ancient Egypt the procedure was performed by the priest using his thumbnail (often gold impregnated) but in due course circumcision knives and other instruments were devised for the operation (Figure 2)[7].

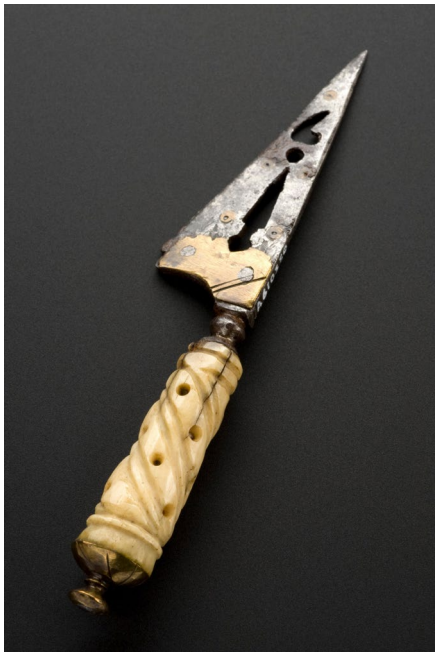

Figure 2: Circumcision knife, Europe, 1775–1785

(Source: Science Museum London. Reproduced under licence)

The ancient Greeks and Romans abhorred the practice of circumcision, believing it to be primitive, barbaric, arising from superstition and a means of oppression[8]. One Hellenistic Greek, King Antiochus IV Epiphanes, outlawed circumcision and those mothers who had their infants ritually circumcised were flogged, crucified or stoned[8].

Circumcision continues to be performed today, in many echelons of society, in developing and developed countries[10] and for religious, ritualistic or medical reasons[11]. The purpose of the procedure determines when it is undertaken, vis-a-vis the age of the patient. It remains a controversial procedure and, for example, the Canadian Paediatric Society recommends that circumcision of newborns should not be routinely performed[10], as does the British Medical Association[12]. In contrast, the American Academy of Pediatrics indicates that the health benefits of newborn male circumcision outweigh the risks and, further, the procedure's benefits justify access to it. Specific benefits identified include prevention of urinary tract infections, penile cancer and transmission of some sexually transmitted infections, including HIV[13,14].

Trephination

As long ago as 10 000 BCE[3], possibly earlier[15], boring or cutting out rings or squares of bone from the skull was practised and, remarkably, many survived this procedure[3]. The practice is known as trephination or trepanation and, although trephination refers to drilling whereas trepanation means scraping or cutting[3], the terms are used interchangeably. Studies related to prehistoric trephination followed the discovery, in a prehistoric stone tomb in central France in the late 19th century, of a skull with a large artificial opening[3] (Figure 3). Since that time many thousands of such skulls have been found. It is also extraordinary that this complex procedure was undertaken in many different parts of the world[3,15], including the United Kingdom, Poland, Spain, Portugal, Scandinavia, the Caucasus, Palestine, the Western coastline of the Americas (especially Peru), North Africa[3] and China[16]. Whether the procedure was practised in ancient Egypt appears to be contested[17] although it was performed in ancient Greece. Trephination was still being practiced in isolated and primitive communities until the early 20th century[18].

It is believed trephination was performed for the management of skull injuries and fractures[3]; however, the procedure was also carried out for other reasons, including:

- intracranial disorders
- chronic headache
- brain tumours
- other painful disorders[3,16].

Figure 3: A Neolithic (3500 BCE) skull showing evidence of trephination

(Source: World History Encyclopedia (by Jmh649). Reproduced under licence).

It was also believed the procedure had a magical and/or religious purpose, that of expelling evil spirits because our forebears thought these were the cause of mental illness, insanity and epilepsy. In parts of New Guinea, it was performed on youths as an aid to longevity[3]. Elsewhere the procedure was thought to confer magical powers on the patient and the pieces of skull retrieved were used as amulets, as they, too, were perceived to have magical properties[3].

However, it appears most cases were done for therapeutic reasons. It was performed much more frequently on men, probably because they sustained far greater numbers of head injuries during tribal warfare. In some prehistoric cultures (e.g. in Peru) it was undertaken on men only[19]. Children were rarely the recipients of trephination[15]. In some cases, trephination was performed peri-mortem or immediately post-mortem, possibly for cultural or ritualistic reasons[16], although it has also been hypothesised that post-mortem trepanation was a means of better understanding cranial anatomy and improving techniques[19].

Scraping, supposed to be the oldest trepanning technique, involved the use of an abrasive stone tool which was rubbed across the skull surface until a perforation was obtained[15]. In terms of survival, it was also the most successful, probably because stone scrapers were more able to avoid accidental penetration of the dura mater. The areas of the skull most often operated upon were the parietal bone followed by the frontal, and the left side of the skull was involved more often than the right[15]. In some cases, the skull had been poly-trephined resulting in two or more holes[3,15].

How this operation was performed without the benefit of anaesthesia, haemostasis or antiseptics, as we know them today, is astonishing. However, management of bleeding from spongy bone would have been necessary and the use of plants or, in the case of ancient Greeks, cautery was used for this purpose[15]. The Incas of ancient Peru were expert naturalists and used extracts from coca plants and alcohol as anaesthetics, various roots and shrubs that are rich in tannic acid as haemostatics and certain mineral salts and chemicals for their antiseptic properties[18].

The presence of early osteoclast activity, bone necrosis or hypervascularity indicated that in many cases the patient survived for at least several weeks; longer term survival was evidenced by extensive bone remodelling[20]. The survival rate for this procedure was impressive and generally believed to exceed 50 per cent[21]. In one study of 400 Peruvian trephinations, 62.5 per cent showed signs of healing[18].

Identifying how these primitive surgical forebears acquired the necessary skills to undertake trephination is speculative. There is some evidence that Neolithic practitioners in Europe learnt their skills by practising on domestic animals[22]. In medieval Europe, it was not until the renaissance, and its associated burgeoning and dissemination of knowledge[3], that more sophisticated trephining became evident (Figure 4).

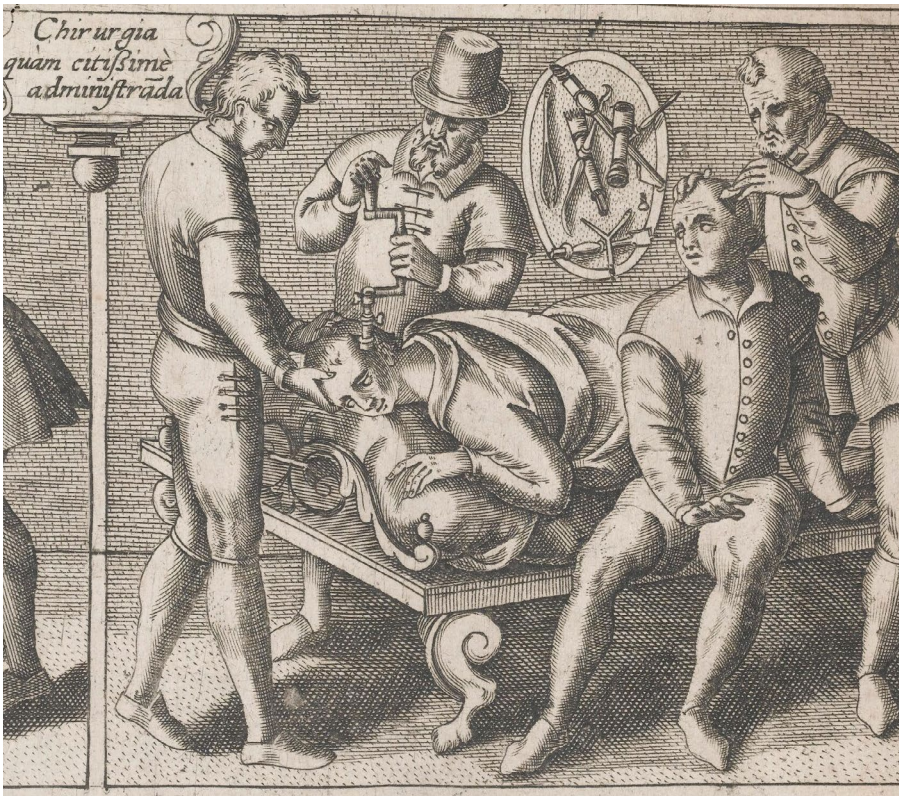

Figure 4: Skull trephining, ca 1594

(Credit: Le chirurgie françoise recueillie des antiens médecins et chirurgiens. Avec plusieurs figures des instrumens necesseres pour l'opération manuelle / Par Jacques Guillemeau. Source: Wellcome Collection. Reproduced under licence.)

Lithotomy

Circumcision and trephination were performed for various reasons – in the case of circumcision, these were religious, cultural or ritualistic. Similarly, although trephination was undertaken for therapeutic reasons, it was also performed for mystical purposes. In contrast, 'cutting for the stone' was undertaken for one reason only, thus it can be deemed to be the most ancient procedure for a single, specific, surgical condition[3].

The most ancient bladder stone found to date was in the grave of a 16-year-old boy, in a prehistoric cemetery at El Amrah in Upper Egypt. It has been dated at 4800 BCE[3,23]. The earliest writings about stone disease, describing symptoms and prescribing treatments to dissolve the stone, are found in the medical texts of *Asutu* in Mesopotamia between 3200 and 1200 BCE[23].

It is in Hindu and Greek writings of the 4th and 5th centuries BCE that the first descriptions of lithotomy are found. Sushruta was a surgeon who lived in ancient India and was the author of a book in which he describes over 300 surgical procedures, including perineal lithotomy[23,24]. He described this operation in meticulous detail, exhorting surgeons to take special care to ensure they did not break the stone so that no pieces were left behind to grow large again[23].

Hippocrates (460–377 BCE) described diseases of the kidney and defined symptoms of bladder stones. In his oath of medical ethics for physicians, Hippocrates outlined that they were not to cut for the stone, but to leave it for practitioners of this work[3,24]. At that time, lithotomy was practiced via a perineal incision and was done by special lithotomists[24]. The Roman encyclopaedist Celus (25 BCE – 50 Common Era (CE)) described the procedure of perineal lithotomy, and this approach persisted for the next 1500 years (Figure 5). It required that the patient be restrained, usually by a parent as Celus believed the operation should only be performed on children between the ages of nine and 14[24]. The operator inserted two fingers of the left hand (dipped in oil) into the anus. The right hand was used to push down on the lower abdomen, pushing the bladder and thus forcing the stone into the grip of the left index finger within the rectum. This caused the stone to bulge in the perineum. An incision was then made in front of the anus into the base of the bladder and the stone was pushed out by the finger in the rectum. If necessary, a hook was used to dislodge it. The wound was then dressed with wool and warm oil[3].

Because the operation involved no special instruments, merely a knife and possibly a hook, it was known

Figure 5: Surgery operating for bladder stones

(Source: Wellcome Collection. Reproduced under licence.)

as the 'operation minor' or the 'petit appariel'[25]. It was carried out without the benefit of anaesthesia and often in public by itinerant, often uneducated, lithotomists who travelled from town to town seeking business[24].

In 1503 a new technique was introduced and, although similar to the 'operation minor', overcame the problem of identifying the bladder neck by the passage of a guide into the bladder along the urethra[25]. Subsequently, a vertical incision was made in the mid-line onto a groove in the guide to open the urethra, which was then progressively dilated[3]. This process tore through the prostate gland and bladder neck. Stone holding forceps were then passed into the wound to remove the stone or, if it was too big, forceps were used to first crush the stone and the fragments then removed with a scoop or hook. This was known as the 'apparatus major' or 'grand apparel' because a large array of instruments was used[3,24,25] (Figure 6). It gradually replaced the lesser procedure and was practiced widely throughout Europe for the next 300 years, despite the complications – haemorrhage, sepsis, incontinence and impotence – all of which were common occurrences[3]. A final refinement to the perineal approach was the lateral lithotomy, which was still being performed up until the 20th century[3] although by then with the benefit of anaesthesia.

The first successful removal of calculi via a suprapubic approach was described by Pierre Franco in 1561[24]. However, he advised others not to follow his example and many surgeons took his advice believing that there would be dire consequences. Nonetheless, it began to be carried out successfully first in France and then in England in the

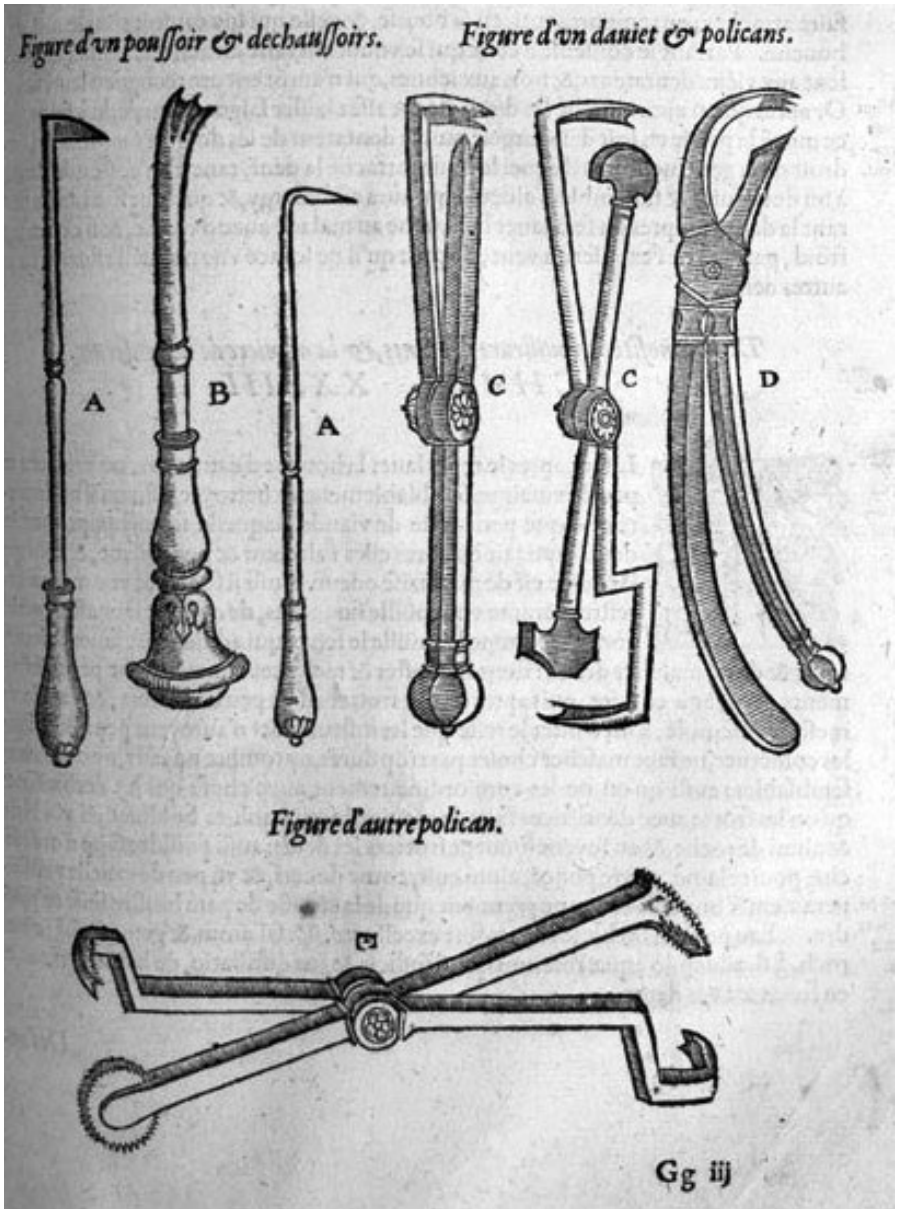

Figure 6: Instruments of Ambroise Paré, 1585

(Source: Historical Medical Books at the Claude Moore Health Sciences Library, University of Virginia.)

18th century. When the surgeon John Douglas realised that the bladder could be opened extra-peritoneally above the pubis when distended with fluid he published a book about it in 1720[3,25]. In it, he listed the advantages:

- it was easier for the patient
- it could be accomplished rapidly
- a cure was more certain
- the approach prevented urinary incontinence, impotence or the formation of fistulae[3].

Despite these improvements, the procedure had a high mortality rate, was performed infrequently and only in cases of large stones. It was not until the end of the 19th century and the many advances occurring in 'modern' surgery – asepsis and

anaesthesia – that the procedure became safe and routine.

Currently, various new technologies have been developed in the effort to make bladder stone treatment less invasive[24]. Stone fragmentation (lithotripsy) can be achieved by using several surgical approaches and devices[26]. However, bladder stones are now rare[26] – mainly seen in developing countries – and eventually they may disappear completely[3].

In summary, an exploration of the earliest operations humans performed shows they stretch back through millennia. Circumcision is possibly the oldest procedure, and the one performed most often and mostly consistently throughout history. It seems to have been undertaken for a plethora of reasons – cultural, religious and medical – and remains a controversial procedure still practiced extensively today. Trephination is the most intriguing procedure performed by our ancestors, given the nature and complexity of such an undertaking, even in the 18th and 19th centuries. It was undertaken for mostly therapeutic purposes; however, in some instances there were mystical reasons associated with it. It, too, continues to be practised today, albeit in such a vastly different way as to be unrecognisable in comparison with its earlier origins. Lithotomy or 'cutting for the stone' was the only one of these procedures that was performed for a sole purpose, and almost always as a last resort. It is also the only procedure that is currently in decline and may even cease to be performed at some point in the future.

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Variations in COVID-19 airway management and preparedness among Victorian hospitals

Summary

The COVID-19 pandemic presents significant concerns surrounding the risk of transmission to health care workers involved in airway management of patients with suspected or known infection. Limited evidence has been available to guide the preparation of staff, intubation environments, team structure and personal protective equipment. Our study invited Victorian hospitals to complete a survey on their airway management practices and protocols, in order to assess the degree of variability in practice and preparedness. Twenty hospitals responded in September 2020, during Victoria's second wave of COVID-19. Forty percent had dedicated COVID-19 intubation teams, all including consultant anaesthetists. Seventy-five percent had negatively pressured dedicated intubation rooms. All provided airborne precautions including N95 masks for airway and cardiac arrest management of suspected or confirmed COVID-19 positive patients, with 35 per cent providing N95 mask fit testing and 15 per cent providing powered air purifying respirators or elastomeric respirators. Thirty-five percent provided airborne precautions for cardiac arrest management of patients not suspected to be COVID-19 positive. Significant inter-hospital variations were reported in airway management practices, such as pre-oxygenation, bag-mask ventilation, medications and techniques to minimise aerosolisation. Although some of this variation was likely due to individual hospital infrastructure and resource limitations, it would be ideal to achieve a more consistent, standardised approach across Victorian hospitals. This study may highlight areas for improvement for some hospitals. These areas for improvement may include consideration of the establishment of COVID-19 intubation teams in at least major metropolitan hospitals, N95 mask fit testing and the use of airborne precautions for cardiac arrest management during times of increased community prevalence of COVID-19.

Introduction

The World Health Organization (WHO) declared the 2019 novel coronavirus (COVID-19) to be a pandemic on 11 March 2020[1]. Despite recent experiences with disease outbreaks, such as influenza, EBOLA and Middle East Respiratory Syndrome Coronavirus (MERS-CoV), the combination of high transmission and mortality rates of COVID-19 made this pandemic an unprecedented event, for which most health care systems in the world were not adequately prepared[1,2].

Health care workers are at increased risk of developing the infection, due to their close contact with patients and each other, and their involvement in procedures that may increase the dispersion of contaminated fluid or aerosols[3,4]. One study showed that one in ten health care workers who were involved in tracheal intubation of patients with suspected or confirmed COVID-19 subsequently reported a COVID-19

outcome, defined as either being diagnosed with new COVID-19 infection or requiring self-isolation or hospitalisation with new symptoms[5]. Hospitals around the world, including those in Australia, had to promptly develop airway management guidelines and protocols with very limited supporting literature at the beginning of the pandemic[6]. Several guidelines then gradually became available as new information emerged, to guide medical professionals on airway management of suspected and confirmed COVID-19 positive patients, including those released by the Safe Airway Society[7], the Anesthesia Patient Safety Foundation[8], the Australian Society of Anaesthetists[3] and the Australian and New Zealand Intensive Care Society[9]. However, variations in practice among hospitals have been reported[10].

Recent concerns have been raised about particular features of Victoria's health system, and whether this may play a role in the significantly higher incidence of COVID-19 that has been observed in comparison to other states[11]. Most of the states in Australia have overarching health structures and central sources of guidelines and standards. In contrast, in Victoria there are six Primary Health Networks (PHNs) and 88 Local Health Care Authorities[12]. Each of the PHNs operates as its own separate entity, making it challenging to integrate and share information and resources across different networks. The aim of this study was to examine how different hospitals in Victoria prepare, coordinate and conduct the airway management of patients with suspected or confirmed COVID-19. This information can be used as a reference for hospital staff who are involved in planning COVID-19 airway management.

Methods

After obtaining approval from Melbourne Health Human Research Ethics Committee (QA2020128), we invited the hospitals that are affiliated with the University of Melbourne to participate in this study[13]. We included all the adult hospitals that have both an anaesthetic department and an emergency department (ED). We excluded hospitals whose ED only caters for psychiatric patients. These inclusion and exclusion criteria were selected in order to encompass hospitals that would be expected to manage the airway of a COVID-19 positive patient requiring intubation. Twenty-nine hospitals were invited to be included.

An invitation email was sent to the directors of the anaesthetic departments of each of the 29 selected hospitals. They then nominated the most appropriate person to complete the pre-designed survey regarding the airway management of suspected or confirmed COVID-19 patients in their hospital. The nominated person was considered to be the leader or one of the leaders in the hospital, involved in the planning and development of the hospital COVID-19 airway management policies or guidelines. The survey consisted of questions regarding the presence and components of COVID-19 intubation teams, intubation environments, personal protective equipment (PPE), airway management equipment, staff preparation and airway management practices (see supplemental material). These questions were designed to allow comparison across these areas, in order to assess inter-hospital variation in practice. We contacted the nominated person via email. The survey was then completed via their preferred method (a phone call from one of the investigators or self-completion and return by email). Consent was implied by their response to our email and the completion of the survey.

The survey took place during September 2020, coinciding with the declining phase of the second wave of COVID-19 cases in Victoria. There were 723 daily cases at the peak in July 2020. The first wave occurred in March 2020. Most hospitals had developed a policy on airway management of suspected or confirmed COVID-19 patients by the time the study was conducted.

Results from the survey were transferred to a standard spreadsheet (Excel; Microsoft, Redmond, WA, USA), and descriptive statistics were used to present all of the data.

Results

Of the 29 hospitals contacted, we received responses from 20 hospitals, giving a response rate of 69 per cent. This included 18 public hospitals (12 metropolitan, six regional) and two private hospitals (both metropolitan). All of the surveys were completed by consultant anaesthetists, three of whom were the director of the anaesthetic department. They were all involved in the development of local COVID-19 airway management policies.

Preparation of the intubation team staff for airway management of suspected or confirmed COVID-19 patients is shown in Table 1. Eight hospitals had established dedicated COVID-19 intubation teams, all of which included consultant anaesthetists, during both in-hours and after-hours periods. Of these eight teams, seven included one nurse only. Three included an ICU nurse, three included an anaesthetic nurse, one included an Emergency Department (ED) nurse and one included two nurses from either ICU, anaesthetics or ED. Ninety-five

Table 1: Preparation of intubation team staff for airway management of suspected or confirmed COVID-19 patients

Preparation and training	No. of hospitals (n = 20)
Intubation staff were fit tested quantitative:qualitative	7 (35%) 5:2
Use of cognitive aid for airway management	18 (90%)
Use of simulation training	17 (85%)
More than 80% of staff involved in intubation received formal training in: • donning/doffing • intubation of COVID-19 patients • extubation of COVID-19 patients	 19 (95%) 19 (95%) 16 (80%)

percent of hospitals provided formal training for personnel involved in COVID-19 airway management, with 85% of hospitals using simulation for this purpose (Table 1). Ninety percent of hospitals used a cognitive aid to assist with airway management of these patients.

Most hospitals (18 of 20; 95%) provided dedicated COVID-19 intubation rooms, with 75 per cent of hospitals (15 of 20) having negatively pressured rooms for this purpose, frequently in the intensive care unit (ICU) and ED (Table 2). The median number of dedicated intubation rooms per hospital was three (ranging between 1 and 12). Seventy-five percent of hospitals reported the use of a dedicated COVID-19 airway trolley (or other transport means such as a container or bucket).

All of the hospitals had oropharyngeal airways, alternative facemasks/laryngeal masks/endotracheal tubes and equipment for front-of-neck access either immediately available in the room or closely available outside the room. Ninety-five percent of hospitals (19 of 20) had their videolaryngoscope and bougie inside the room. Only one hospital did not have a hyper-angulated laryngoscope available. However, six of the hospitals (30%) did not have immediate access to a fibreoptic bronchoscope if required. A variety of protocols were used in different hospitals for both intubation and extubation procedures, as shown in Table 3.

In terms of PPE, all of the hospitals provided gowns, gloves, hats, N95 particulate respirator masks and face shields for the staff who were involved in COVID-19 airway management. Three hospitals (15%) provided the option of using powered air purifying respirators (PAPRs) or elastomeric respirators as an alternative to N95 masks. Neck covers were only used by three hospitals. Seven hospitals (35%) provided N95 mask fit testing (Table 1).

In regard to the cardiac arrest team for suspected or confirmed COVID-19 patients, 11 hospitals (55%) included an anaesthetic registrar or consultant. All of the 20 hospitals provided the same PPE that was worn by staff intubating suspected or confirmed COVID-19 positive patients. Only seven out of 20 hospitals (35%) had a similar requirement for airborne precautions including the use of N95 masks at the attendance of cardiac arrests of patients not suspected or known to be COVID-19 positive. All of these seven hospitals were metropolitan hospitals.

Table 2: General approach for the airway management of suspected or confirmed COVID-19 patients

Intubation team and environment	No. of hospitals (n=20)
Dedicated intubation team for COVID patients	8 (40%)
Same team during afterhours	4/8 (50%)
Dedicated intubation room(s)	18 (90%)
Dedicated intubation room(s) that are negatively pressured	15/18 (83%)
Dedicated intubation trolley	15 (75%)
Videolaryngoscopes available at all times	20 (100%)
Intubation practice	
Limit maximum oxygen flow	13 (65%)
Bag-mask ventilation not allowed	3 (15%)
Protocol for medications to be used	10 (50%)
Mandated clamping of endotracheal tube	15 (75%)

Table 3: Details of the protocols used for airway management of suspected or known COVID-19 patients

	Yes	No
Pre-oxygenation protocol	**13 (65%)**	**7 (35%)**
Limit to maximum of 4L/min	1	
Limit to maximum of 6L/min	10	
Limit to maximum of 15L/min	2	
BMV protocol	**14 (70%)**	**6 (30%)**
BMV not allowed	3	
Allowed if low SpO2	11	
• SpO_2 < 80%	3	
• Anaesthetist's discretion	7	
• Life threatening situation	1	
Medication protocol	**10 (50%)**	**10 (50%)**
Induction agent protocolised	7	
• Ketamine	4	
• Propofol	3	
NMB protocolised	9	
• Rocuronium	6	
• Suxamethonium	3	
Opioid protocolised	5	
• Fentanyl	3	
• Alfentanil	2	
Extubation protocol	**9 (45%)**	**11 (55%)**
Plastic sheet	8	
Deep extubation	2	
NIV protocol*	**14 (78%)**	**4 (22%)**
Allowed	8	
Prohibited	6	
HFNP protocol	**17 (85%)**	**3 (15%)**
Allowed	13	
Prohibited	4	

*NIV protocol – two hospitals did not respond (n=18)

BMV = bag-mask ventilation; SpO2 = oxygen saturation with pulse oximetry; NMB = neuromuscular blockade; NIV = non-invasive ventilation; HFNP = high-flow nasal prongs

Discussion

All of the 20 responding Victorian hospitals had a policy on airway management of suspected or confirmed COVID-19 patients. However, we found a noticeable amount of variation, not only in the intubation procedure protocols, but also in preparation, training, intubation environment, team structure and PPE use. Multiple factors could have potentially contributed to these variations. They include:

1. lack of evidence to guide a definitive protocol
2. different staff resource capacity
3. different levels of suspected and/or confirmed COVID-19 cases due to different geographic locations
4. environmental constraint
5. different levels of equipment supply and availability.

Moreover, the lack of an overarching health care structure, which would assist in the integration of resources and sharing of information among different health care networks in Victoria, may also have been a potential contributing factor.

It has been suggested that dedicated and experienced COVID-19 intubation teams, such as those using anaesthetists or anaesthetic registrars as lead intubators, may improve patient outcomes and staff safety[14]. This is understandably challenging for some regional hospitals, where the case load is low and resources are limited. Nonetheless, major metropolitan hospitals should consider establishing a COVID-19 intubation team, absent in more than half of the metropolitan hospitals in this study.

Several consensus guidelines specific to airway management of suspected and confirmed COVID-19 positive patients recommend that negative pressure rooms should be

used where possible during tracheal intubation of these patients, in order to minimise staff exposure to aerosol and droplet particles[3,7]. This is obviously constrained by the hospital environment. The majority of the studied hospitals had dedicated COVID-19 intubation rooms, most of which were negatively pressured. However, we noticed that most COVID-19 intubation rooms that were located in the operating theatre environment were not negatively pressured. The Safe Airway Society consensus statement about principles of airway management and tracheal intubation specific to the COVID-19 adult patient group reports that positive pressure ventilation environments are common in the operating theatre and should be avoided[7].

The use of airborne precautions is recommended in the intubation of high risk (suspected or confirmed COVID-19 positive) patients[15,16]. It is reassuring that all hospitals provided N95 masks, gowns and eye shields for intubation of suspected and confirmed COVID-19 positive patients. Only a minority provided the option of the use of PAPRs or elastomeric respirators. The use of PAPRS or elastomeric respirators is controversial. A recent Cochrane review concludes that the use of a PAPR with coverall may protect against the risk of contamination better than an N95 mask and gown[17]. However, there are concerns regarding their supply and training in donning, doffing and cleaning. Similarly, most hospitals did not provide neck covers for use during intubation of these patients. Interestingly, studies using fluorescent markers as a surrogate measure for contamination have suggested that the neck may be a high risk setting for potential contamination during intubation[18]; however, most guidelines, including the WHO guideline, do not recommend the use of head and neck covers in this setting[19].

The Australian Guidelines for the Prevention and Control of Infection in Health care state that N95/P2 masks require formal fit testing, in order to identify suitable size and style of mask, and to ensure their correct use[20]. Despite this, most of the hospitals included in this study did not provide N95 mask fit testing, which can be expensive and logistically challenging. It can also consume an extensive number of N95 masks, which may not be ideal during a pandemic[21]. However, this is likely to have improved as the Department of Health and Human Services (DHHS) has recently developed and supported the Respiratory Protection Program at various Victorian health services[22].

In the management of cardiac arrest of patients suspected or known to be COVID-19 positive, it is reassuring that every hospital provided the equivalent PPE as that worn during airway management of this patient cohort, which is in keeping with recommendations from the DHHS[23]. Unless there is clear evidence to the contrary, the Australian College of Emergency Medicine (ACEM) recommends that while there are high rates of community transmission of COVID-19 any collapsed or unresponsive patient should be assumed to be high-risk for COVID-19, and that airborne PPE should be worn[24]. The significantly higher adaptation of this recommendation for airborne precautions in this setting in metropolitan hospitals, compared to regional hospitals, potentially reflects the higher prevalence of COVID-19 in the metropolitan regions.

One of the potential factors leading to variations in the COVID-19 airway management among different hospitals is the lack of evidence in literature to guide practices. One major uncertainty or controversy is the degree of aerosolisation of COVID-19 during airway manipulation. This may have contributed to the inter-hospital variability seen in the limitation of oxygen flows for pre-oxygenation, the decision path and trigger for bag-mask ventilation, the protocolisation of drugs used on induction, the mandated clamping of the endotracheal tube for circuit disconnections, extubation practices and the use of high-flow nasal prongs and non-invasive ventilation. This cross-sectional study highlights a large variation in practice among hospitals, despite increasing numbers of publications that are emerging to provide more understanding about aerosol generation during airway management[25,26].

Limitations

There are several limitations in this study. It involved only 20 Victorian hospitals, which is a small sample size. However, we included all of the major metropolitan hospitals and many regional hospitals and we believe this is a reasonable representation of Victorian hospitals. There was a selection bias, as we included only the hospitals that responded to our email invitation. Inter-hospital variation in who was nominated to complete the survey and how this decision was made may be present. There is an assumption that individual hospital airway management practices align with their policies, where this may not be the case. Finally, this study is only a snapshot of practices across different Victorian hospitals in September 2020. There are constant changes in COVID-19 management guidelines and practices as new information continues to emerge. Nonetheless, this cross-sectional study highlights a large variation across different hospitals.

Conclusion

In conclusion, this study compared how different hospitals in Victoria prepare, coordinate and conduct the airway management of patients with suspected or confirmed COVID-19. We found inter-hospital variability in many areas. This study can be used as a reference and may potentially highlight areas for improvement for some hospitals. Further studies would be beneficial to investigate the reasons behind the variations, and to examine whether there is less variation in other states which have an overarching health care structure. We should also consider the implications of these differences, for example, potential differences in the quality of care of COVID-19 positive patients, potential differences in transmission risk within hospitals and staff wellbeing impacts regarding conflicting information and management of these patients in different locations.

Declaration of conflicting interests

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Variations in COVID-19 airway management and preparedness among Victorian hospitals

Supplementary material

An audit on COVID-19 airway management across Victorian Hospitals

Project lead person: Dr Kaylee Jordan

Other key personnel: Prof. Reny Segal, Dr Irene Ng, Dr Keat Lee, Dr Roni Krieser, Dr Paul Mezzavia, Ms Teresa Sindoni, Ms Yinwei Chen

1. General Information

Name of hospital: .....

- ☐ Major metropolitan
- ☐ Public – metropolitan
- ☐ Private – metropolitan
- ☐ Public – regional
- ☐ Private – regional

2. Teams

2.1 Do you have a dedicated COVID-19 intubation team at your hospital?

☐ Yes ☐ No

2.2 If so, who makes up the team? (how many)

- ☐ ED consultant/registrar (..... / .....)
- ☐ ED nurse (.....)
- ☐ Anaesthetic consultant/registrar (..... / .....)
- ☐ Anaesthetic nurse (.....)
- ☐ ICU consultant/registrar (..... / .....)
- ☐ ICU nurse (.....)
- ☐ Others – please specify:

.....

2.3 Are all members of this team included in the after-hours COVID-19 intubation team?

- ☐ Yes
- ☐ No (specify who is not in this team after hours)

.....)

2.4 Who makes up the Code Blue team for suspected/known COVID-19 patients?

- ☐ ED consultant/registrar (..... / .....)
- ☐ ED nurse (..... / .....)
- ☐ Anaesthetic consultant/registrar (..... / .....)
- ☐ Anaesthetic nurse (.....)
- ☐ ICU consultant/registrar (..... / .....)
- ☐ ICU nurse (.....)
- ☐ Orderly/theatre technician (..... / .....)
- ☐ Others – please specify:

.....

3. Environment

3.1 Do you have dedicated Covid-19 intubation rooms in the hospital?

- ☐ Yes (How many and where: .....)
- ☐ No

3.2 If so, are these rooms negatively pressured?

☐ Yes ☐ No

☐ Others – please specify:

.....

4. PPE

4.1 When intubating a suspected/known Covid-19 patient, which of the following PPE equipment is required to be worn at your hospital? (tick all that apply)

- ☐ Gown (long sleeved/short sleeved)
- ☐ Hat
- ☐ Neck cover
- ☐ Goggles
- ☐ Eye shield
- ☐ N95 mask
- ☐ P2 mask
- ☐ Powered Air Purifying Respirator (PAPR)
- ☐ Shoe covers
- ☐ Others – please specify:

.....

4.2 Does your hospital/department provide N95 mask fit testing for staff who are involved in intubation of suspected/known COVID-19 positive patients?

- ☐ Yes (quantitative/qualitative)
- ☐ No

4.3 Are the same protective equipment worn for attendance at cardiac arrests of patients suspected/known COVID-19 positive?

- ☐ Yes
- ☐ No (specify which of the items ticked above are **not** worn

.....)

4.4 Are the same protective equipment worn for attendance at cardiac arrests of patients not suspected/known to be COVID-19 positive?

- ☐ Yes
- ☐ No (specify which of the items ticked above are **not** worn .....)

5. Equipment

5.1 Is there a dedicated COVID-19 airway trolley in your hospital?

☐ Yes ☐ No

5.2 Regarding the following equipment, please select whether each are available during a suspected/known Covid19 intubation, in your department either:

a) in the room

b) outside the room or

c) not available.

Equipment	In the room	Outside the room	Not available
Alternative facemasks			
Guedels			
Videolaryngoscope			
Hyperangulated laryngoscope			
Alternative ETTs			
Bougie			
Stylet			
Alternative LMAs			
CICO kit: Needle cricothyroidotomy Scalpel/bougie Melker			
Fibreoptic bronchscope			

5.3 Does your hospital/department use cognitive aid for airway management of suspected/known COVID-19 patients?

☐ Yes ☐ No

6. Preparation

6.1 Have the majority (>80%) of your team received formal training in (tick those that apply)

- ☐ Donning/doffing
- ☐ Intubation of a suspected/known COVID-19 positive patient
- ☐ Extubation of a suspected/known COVID-19 positive patient

6.2 Does your hospital/department use simulation training for management of suspected/known COVID-19 positive patients?

☐ Yes ☐ No

7. Practice

7.1 When inducing someone with suspected or known COVID-19 in your department, do you have a protocol for maximum oxygen flows to be used?

- ☐ Yes (please specify .....)
- ☐ No

7.2 When inducing someone with suspected or known COVID-19 in your department, do you have a protocol for medications to be used?

- ☐ Yes (please specify .....)
- ☐ No

7.3 When inducing someone with suspected or known COVID-19 in your department, do you have a protocol specifying whether/when you should bag mask ventilate (BMV)?

- ☐ No protocol
- ☐ Protocol – routinely BMV
- ☐ Protocol – never BMV
- ☐ Protocol – BMV only if oxygen saturations fall below a trigger

(specify .....)

7.4 When intubating a patient with known or suspected COVID-19 in your department, is a video laryngoscopy available for all intubations?

- ☐ Available at all times
- ☐ Limited availability
- ☐ No availability

7.5 When swapping between equipment for ventilation (e.g. between ventilators or self-inflating bag to ventilator), does your hospital/department mandate clamping of the ETT?

☐ Yes ☐ No

7.6 When extubating a patient with suspected or known COVID-19 in your department, does your hospital protocol recommend any of the following precautions?

- ☐ Plastic bag
- ☐ Plastic box
- ☐ Deep extubation
- ☐ Other (please specify

.....)

7.7 When managing COVID positive patients in your department, does your hospital specify whether either of the following may be used if required?

a) NIV

- ☐ No protocol
- ☐ Prohibited
- ☐ Allowed

b) HFNP

- ☐ No protocol
- ☐ Prohibited
- ☐ Allowed

Pre-operative and post-operative recommendations to surgical wound care interventions: A systematic meta-review of Cochrane reviews

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Abstract

Background: The increasing numbers of surgeries involving high risk, multi-morbid patients, coupled with inconsistencies in the practice of perioperative surgical wound care, increases patients' risk of surgical site infection and other wound complications.

Objectives: To synthesise and evaluate the recommendations for nursing practice and research from published systematic reviews in the Cochrane Library on nurse-led pre-operative prophylaxis and post-operative surgical wound care interventions used or initiated by nurses.

Design: Meta-review, guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Data sources: The Cochrane Library database.

Review methods: All Cochrane Systematic Reviews were eligible. Two reviewers independently selected the reviews and extracted data. One reviewer appraised the methodological quality of the included reviews using A MeaSurement Tool to Assess Systematic Reviews 2 (AMSTAR 2) checklist. A second reviewer independently verified these appraisals. The review protocol was registered with the Prospective Register of Systematic Reviews.

Results: Twenty-two Cochrane reviews met the inclusion criteria. Of these, 11 reviews focused on pre-operative interventions to prevent infection, while 12 focused on post-operative interventions (one review assessed both pre-and post-operative interventions). Across all reviews, 14 (63.6%) made at least one recommendation to undertake a specific practice, while two reviews (9.1%) made at least one specific recommendation not to undertake a practice. In relation to recommendations for further research, insufficient sample size was the most predominant methodological issue (12/22) identified across reviews.

Conclusions: The limited number of recommendations for pre- and post-operative interventions reflects the paucity of high-quality evidence, suggesting a need for rigorous trials to address these evidence gaps in fundamentals of nursing care.

What is already known about the topic?

- Surgical wounds are the most common wounds managed in acute care settings.
- Surgical wound care is an interprofessional activity, although it is predominantly nurse-led.
- There is considerable variability in surgical wound care practice, which may reflect overuse of ineffective care, underuse of effective care or uncertainty as to what constitutes appropriate care.

What this paper adds

- The quality of the primary studies included in Cochrane Reviews may determine the level to which clinicians are able, or feel compelled, to implement reviewers' recommendations in clinical practice.
- Clinical recommendations made in pre- and post-operative surgical wound management are weak or conditional because of methodological limitations and gaps in the current evidence base.
- Analysis of design and methodological rigour of included reviews identified the need for larger sample sizes, longer follow-up periods and inclusion of economic evaluations.

Introduction

Worldwide, an estimated 4511 operations per 100 000 population occur annually, equating to one surgical procedure each year for every 22 people[1]. Surgical wounds are the most common wounds managed in acute care settings and are associated with a variety of complications such as bleeding and dehiscence. However surgical site infections are the most common complication – and they are also the most preventable hospital acquired infection[2]. Internationally, surgical site infection rates are estimated to range from 1.9 per cent[3] to 40 per cent of surgeries[4]. One in four patients develop post-operative complications within 14 days of hospital discharge[5]. Consequently, current estimates suggest surgical wound complications account for almost 4 per cent of total health care system costs, and that proportion is rising. One case of surgical site infection can cost up to $30 000 depending on its severity[6].

In acute care settings, there is considerable variability in surgical wound care, reflecting overuse of unhelpful and ineffective care, underuse of effective care, or clinician uncertainty as to what constitutes appropriate care. Inconsistent practices often arise due to conflicting research evidence and variations in clinician preferences, which compromise attempts to limit or reduce iatrogenic harm and patients' risk of surgical site infection and other wound complications[7]. Although there are many surgical site infection prevention clinical practice guidelines, they are of variable quality and differ in their recommendations[8]. Further, the plethora of wound care products and aggressive marketing strategies in the absence of strong supporting evidence accentuates the complexities bedside nurses face when attempting to use an evidence-based approach[9]. The routine use of ineffective and often expensive wound care products and/or inappropriate use of effective products is not uncommon[9,10].

While surgical wound care involves interprofessional teams, registered nurses often lead these teams and frequently make nursing decisions, or recommendations to other health professionals, regarding various interventions for managing surgical wounds. High-quality systematic reviews of the literature, such as Cochrane Reviews, provide evidence syntheses upon which to base these decisions. Cochrane Reviews follow a stringent, peer-reviewed methodology that ensures all relevant studies are retrieved, are appraised for risk of bias, and their findings synthesised with the aim of generating and grading recommendations that guide both current practice and future research. Additionally, we have followed a similar process in focusing on only Cochrane Reviews (for the reason already stated) as have a previous group who undertook a meta-review of wound care five years ago[11].

This meta-review aimed to synthesise and evaluate the recommendations for practice and research contained within published Cochrane Systematic Reviews relating to pre-operative and post-operative surgical wound care interventions for preventing surgical site infection that were within the scope of nursing practice.

Materials and methods

Design

A meta-review of systematic reviews was undertaken in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines[12] and quality of individual reviews was assessed using A MeaSurement Tool to Assess Systematic Reviews 2 (AMSTAR 2) checklist[13]. The review protocol was registered with the Prospective Register of Systematic Reviews (number withheld for blinded review).

Inclusion/exclusion criteria

The setting (S), population (P), intervention (I), comparison (C), and evaluation (E) framework[14] was used to guide inclusion criteria, and report review characteristics.

Setting: The setting for this meta-review was any care environment including hospital, home, residential aged care or long-term care.

Population: Authors focussed on Cochrane reviews that included patients with a surgical wound, defined by the World Health Organization as 'a wound created when an incision is made with a scalpel or other sharp cutting device and then closed in the operating room by suture, staple, adhesive tape, or glue and resulting in close approximation to the skin edges'[15 p.10]. As such, episiotomies and full thickness skin grafts were included as types of surgical wounds. For reviews that examined multiple wound types including chronic wounds (e.g. venous, arterial or diabetic ulcers), only those studies or data relating to surgical wounds were included. Reviews which examined wounds outside the World Health Organization definition of a surgical wound were excluded.

Intervention: Reviews were required to examine nursing interventions for surgical wound care, defined as pre- or post-operative interventions for surgical wounds that may be implemented by registered nurses or interventions that registered nurses may recommend to other health professionals to implement in any care setting. Thus, interventions included but were not limited to, skin preparation, dressing removal, negative pressure therapy devices, debridement and use of topical agents, e.g. silver or aloe vera, and use of topical antibiotics and antiseptics. Reviews could comprise individual studies with randomised and/or non-randomised designs.

Reviews were excluded if they focused only on interventions provided by other health professionals such as surgeons or interventions for which nurses cannot make recommendations. These comprised interventions performed during the intra-operative period, (e.g. surgery), electromagnetic therapy or medication prescriptions.

Comparator: There were no restrictions on the comparators used, and comparators were as defined by review authors.

Evaluation: This review assessed specific recommendations made as described in the 'implications for practice' and 'implications for research' sections of the reviews and within the abstract. Practice recommendations were categorised according to:

a) the level of certainty of the evidence underpinning that particular recommendation which, in some reviews, was determined using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) criteria[16] of risk of bias, precision, indirectness, inconsistency, and selective reporting

b) how strong or unambiguous the recommendation was in regards to undertaking, or not undertaking, a specific practice.

Recommendations for research were grouped into three categories (e.g. further/better quality research needed) and methodological issues included ten categories (e.g. larger samples, greater statistical power, longer follow-up periods). Pre- and post-operative research outcomes from each review were classified based on 16 categories (e.g. cost, different setting/population, quality of life).

Search strategy

There were no date restrictions. A search of the Cochrane Library website (www.cochranelibrary.com/search) was conducted on 1 November 2018 for all published Cochrane reviews. The word 'wound' was the search term used in titles, abstract or keywords and these reviews screened. In the searches, only the word 'wound' was used to ensure that any relevant reviews were not missed. Thus, more time was allocated to screening more reviews.

Review section

Retrieved abstracts and titles were exported to an Endnote library for screening, with full-text articles obtained in cases requiring further information to enable screening. Two authors (WC, CW) independently screened all reviews to determine which should be selected based on inclusion and exclusion criteria. Instances of disagreement between the two authors regarding review inclusion were resolved by discussion and consensus.

Data extraction

Data extraction was conducted on each review independently by pairs of two authors (BG, RW, EM, ZM, AE, EH, CW) and adjudicated by a third (WC) if required. Data extraction included the following information (where available): source (author, year, reference, number of pages in full review and reference list), sample size (number of studies and participants identified), interventions and their comparators, outcomes, risk of bias (i.e. randomisation, allocation concealment, blinding, loss to follow up) and/or certainty of the body of evidence (using GRADE criteria[16]), recommendations for practice,

and implications for research. The extracted data was checked between reviewers and discrepancies resolved through discussion.

A standardised structured data extraction form was developed by the authors, with two reviewers piloting this data extraction form on two reviews, which led to further refinements. To minimise potential for conflicts of interest in the review process, authors of this meta review who were also co-authors of several included Cochrane reviews were not involved in reviewing the reviews that they co-authored. Authors who undertook data extraction underwent training and extracted data from two reviews each, with further training planned if discrepancies were seen, but there were none. As Cochrane reviews are presented in a 'standard' format, a data dictionary detailing where in each review the data was to be exacted from was also developed and used to ensure consistency in data extraction.

Data was also extracted on the risk of bias assessments made by the review authors on each study within their review. Notations were also made of reviews published before and after the Cochrane Library adopted the GRADE system of assessing certainty of evidence and strength of recommendations[16]. Reviews preceding GRADE criteria used risk of bias tables only, while those following both risk of bias tables and GRADE criteria, with relevant information extracted for both types of review. No attempt was made to re-appraise the reviews regarding risk of bias or GRADE criteria, with the original authors' ratings being accepted as valid.

Quality assessment

The methodological quality of the reviews was assessed using a validated 16-item measurement tool: AMSTAR 2 checklist[13]. The responses to the checklist items were scaled as 'fully performed', 'partially performed' or 'not at all performed' and 'yes' or 'no' as to whether data were pooled for meta-analysis. The AMSTAR 2 checklist identifies critical and non-critical domains that must be met in a review, as these affect the validity of the conclusions. The creators of the tool stress that items should not be summed; rather appraisers should consider the overall quality relative to 'critical domains' (items 2, 4, 7, 9, 11, 13 and 15) and 'non-critical weaknesses' (items 1, 3, 5, 6, 8, 10, 12, 14, 16)[13]. The overall rating of confidence in the quality of reviews is based on 'high' (no or one non-critical weakness), 'moderate' (more than one non-critical weakness), 'low' (one critical flaw with or without non-critical weaknesses) and 'critically low' (more than one critical flaw with or without non-critical weaknesses). For this meta-review, two appraisers (EH, CW) independently assessed a subsample of ten (45.5%) reviews and achieved good agreement (at least 80% as recommended by tool developers[13]). Then one appraiser (EH) completed the rest of the assessments, with another author (WC, BG) contacted in instances where EH was uncertain. Any disagreements were resolved through discussion and, when needed, final adjudication by a third reviewer (WC).

Data synthesis

Recommendations for practice and research were synthesised in narrative form, with evidence tables provided which contained quantitative effect estimates underpinning the recommendations, where available. Recommendations were categorised as being either 'specific' or 'general'. Specific recommendations included interventions that directly related to wound care practice and/or management, whereas general recommendations were considered as applicable to any areas of clinical practice, such as cost issues, patient condition. Content analysis of research recommendations using both inductive and deductive techniques was undertaken, and results presented in tabular format for both pre-operative and post-operative surgical wound interventions. This content analysis was directed by the following questions:

- Are practice and/or research recommendations made? (no/yes)
- What are the practice and/or research recommendations?
- How many practice recommendations are made to undertake a practice (i.e. to do something)?
- How many recommendations are made to not undertake (or stop) a practice (i.e. to not do something)?
- What is the certainty or quality of the body of evidence for each recommendation?

Results

Identification and selection of reviews

Figure 1 displays the PRISMA flow chart of Cochrane reviews used to identify and select reviews for inclusion. Our search identified 408 records, of which 386 were excluded after screening titles and abstracts, and a further four excluded after reading full-text articles, leaving 22 reviews that were included for analysis based on selection criteria. All reviews were published between July 2006 and October 2018. Of the 22 included reviews, one review[17] assessed both pre-operative and post-operative interventions.

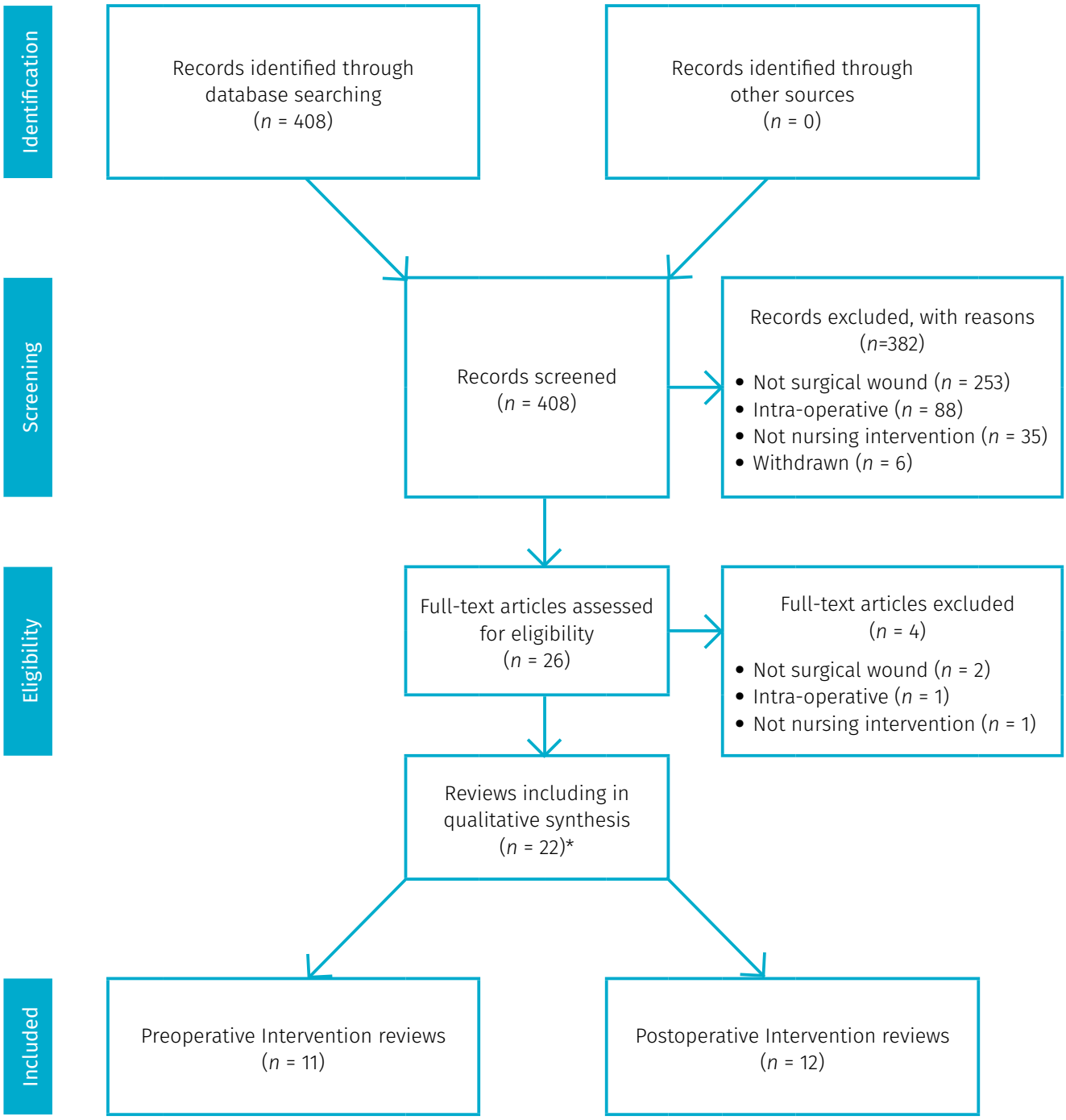

Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow chart

* One review assessed both pre-operative and post-operative interventions for surgical wounds.

Characteristics of the included reviews

Study characteristics relative to pre-operative and post-operative reviews respectively are provided in the supplemental material. Of 22 included reviews, 11 reviews focused on pre-operative interventions and 12 focused on post-operative interventions, with one[17] focusing on both pre- and post-operative interventions. There were 183 primary studies on surgical wounds from 33 countries across the included reviews. The top three countries where the primary studies were conducted were the United States (n = 54), the United Kingdom (n = 32) and Denmark (n = 10). Three reviews included studies that were multinational[18–20].

Twelve (54.5%) reviews were published after 2014 and reported the additional GRADE criteria, and six (27.3%)[17,21–25] were published by authors who were not members of the Cochrane Wounds group. Sixteen (72.7%) reviews comprised solely randomised controlled trials, while five (22.7%) included both randomised and quasi-randomised control trials. A single review had no studies[24] although it met the inclusion criteria and represented a gap in knowledge relative to education as a pre-operative intervention.

Findings of the included systematic reviews

Across all reviews, review authors made eight specific 'to do' recommendations and two specific 'not to do' recommendations. Table 1 details the recommendations for clinical practice across the pre-operative and post-operative Cochrane Reviews. Of the 11 pre-operative reviews, five reviews made at least one specific 'to do' recommendation while one review made at least one 'do not do' recommendation. Of the 12 post-operative reviews, three made at least one specific recommendation to do something while one review made at least one specific recommendation not to do something. In all, eight specific recommendations were made to do something, and two specific recommendations were made not to do something. Across reviews, there were ten general recommendations, such as considering costs, patient preferences, relative benefits and potential harms.

Recommendations for research

The supplemental material shows the recommendations for future research in respect to methodological issues and recommendations in relation to other outcomes identified across reviews of pre-operative and post-operative surgical site infection prevention interventions respectively. In terms of pre-operative interventions, ten reviews recommended that further research was needed in gauging the certainty of effects of the interventions trialled, with five reviews concluding more rigorous research was needed in overcoming insufficient sample sizes (7/11), short follow up periods (3/11) and suboptimal compliance with the reporting standards of the CONsolidated Standards of Reporting Trials Statement (3/11). Topics cited as in need of more investigation included adverse events/effects (6/11) and new comparisons between different interventions (6/11).

Regarding reviews of post-operative surgical site infection prevention interventions, all included reviews recommended the need for further high-quality research (see supplemental material 3) in dealing with issues of insufficient sample sizes (6/12) and limitations in allocation concealment (6/12). Analyses of cost-effectiveness (9/12) and quality of life (7/12) were nominated as topics for future studies.

Quality of included reviews

The methodological quality of the reviews as determined by the AMSTAR 2 checklist is shown in the supplemental material. For reviews that did not include any identified studies or were not able to conduct a meta-analysis, some items were not able to be analysed. Therefore, one review could not assess items 8 and 11 to 15, while seven reviews could not assess items 11, 12 and 15. Across reviews, the percentage of all reviews meeting each criterion ranged from 57 to 100 per cent in regards to the denominator of assessable items. In all, 15 reviews were rated as 'high quality'[17–24,26–32], two as 'moderate quality'[34,35], four as 'low quality'[35–38] and one 'critically low quality'[25]. A single review[24] found no studies that met their eligibility criteria and so a term 'no studies identified' was used as some items could not be assessed.

Discussion

This meta-review of Cochrane reviews described pre- and post-operative surgical wound interventions within nurses' scope of practice and examined their methodological quality and synthesis of recommendations for practice and research. Undoubtedly, registered nurses' scope of practice varies across countries relative to what is considered extended practice (e.g. debridement, prescription of topical ointments). Therefore, the application of these recommendations may necessarily differ. Most recommendations for clinical practice were general rather than specific, e.g. within the context of cost[20,27,35], quality of the body of evidence[18,20,33,37,38], likelihood of harm[27,30,35], and/or patients' and clinicians'

Table 1: Clinical recommendations for pre-operative and post-operative surgical wound practice (n = 22)

	Area of surgical wound care practice	Specific 'to do' recommendations	Specific 'do not do' recommendations	General recommendations	Review reference
Pre-operative practices	Removal of nail polish and rings	1. Develop local policies based on expert opinion of clinicians.			Arrowsmith et al. (2001)
	Pre-operative skin antiseptics			1. Consider potential side effects of alternative skin preparation solutions. 2. Consider costs.	Dumville et al. (2015)
	Vaginal cleansing with antiseptic solution before caesarean section	2. Implement pre-operative vaginal cleansing with povidone-iodine or chlorhexidine before caesarean deliveries.			Haas et al. (2018)
	Nasal decontamination in *Staphylococcus aureus* carriers.			3. Consider potential side effects when choosing between alternatives. 4. Consider costs	Liu et al. (2017)
	Prevention of infection in arterial reconstruction	3. Use antibiotic prophylaxis using antibiotics that fight staphylococcal and Gram-negative bacteria.			Stewart et al. (2006)
	Pre-operative hair removal	4. If hair removal is needed, clip.			Tanner et al. (2011)
	Pre-operative shaving		1. Shaving should not be part of routine clinical practice.		Tanner et al. (2011)
	Pre-operative bathing or showering with skin antiseptics to prevent surgical site infection	5. Focus on interventions where effect is evident.			Webster and Osborne (2015)
Post-operative practices	Negative pressure wound therapy for skin grafts and surgical wounds healing by primary intention		1. Avoid using negative pressure wound therapy following orthopaedic surgery until safety in this population is established.	1. Consider patient preferences when choosing dressings. 2. Consider costs.	Webster et al. (2014)
	Dressings or surgical incisions	1. Use antibiotic prophylaxis.		3. Use existing evidence and guidelines, e.g., hand hygiene.	Dumville et al. (2016)
	Early versus delayed post-operative bathing or showering	2. Consider the quality of water. 3. Consider the type of wound (i.e., primary/secondary closure).			Toon et al. (2015)
	Water for wound cleansing			4. Consider relative benefits of cleansing clean surgical wounds. 5. Consider the patient's general condition, including comorbidities	Fernandez and Griffiths (2012)
	Pin site care for external bone fixators			6. Implement general strategies to reduce cross-infection.	Lethaby et al. (2013)

preferences[20]. Recommendations made by review authors to either stop, or not do something clearly focussed on reducing potential side effects or harm[20,37]. Our findings suggest that most clinical practice recommendations across reviews were tentative or conditional because of methodological limitations and gaps in the evidence base. Given these apparent high levels of uncertainty in wound care[8,9,26,20], the guidance given to clinicians is more general than specific.

Despite a strong desire to adopt evidence-based practice, many clinicians practice within the constraints of ongoing uncertainty, and base their clinical decision-making on intuition[39], personal experience, peer opinions, professional norms, and past teaching[9,40,41]. When confronted with a clinical conundrum, health professionals often make decisions founded on their internalised tacit guidelines and mental 'rules of thumb' (or heuristics)[39]. Although this approach may suffice for many decisions, intuitive decision-making is predisposed to various types of 'cognitive biases' that can distort the synthesis and accurate interpretation of information presented[39]. Cognitive biases such as 'attribution bias' (based on my clinical experience I believe this intervention is effective), 'impact bias' (this intervention is working well and the patient's wound seems to be improving) and 'ambiguity bias' (I am unsure about what to do so I will stick with what I know and what everyone else seems to do)[39] influence clinical decision-making in wound care. However, it is difficult to determine whether the clinical care delivered is low or high value when the evidence is so poor or non-existent. In the absence of high-quality evidence, there is a risk that what may eventually be shown to be ineffective or even harmful care is perpetuated over time. For instance, despite the very low certainty of evidence on the prophylactic use of negative pressure wound therapy in preventing surgical site infection, the use of these devices is increasing in surgical care because of clinicians' preferences and the prolific marketing by industry[9,20]. Therefore, there is a propensity to make clinical decisions based on limited/weak evidence, or on outdated evidence, which increases the risk that at least some of this care is likely to be of low value. Low value care is care that provides limited or no benefit, may cause patient harm, or may yield costs that are disproportionate to added benefits[7].

While all but one review[21] recommended that further trials be undertaken to expand the base of high quality evidence, what remains unclear is the extent to which some of the questions / topic areas highlighted in these reviews are most important to clinicians and consumers. For example, it is questionable whether more research would be of value in investigating removal of nail polish prior to surgery. Further, in surgical wound care and recovery, attention is now being focussed more on lifestyle interventions (e.g. nutrition, early post-operative mobilisation) in combination with other wound care interventions. Nonetheless, interventions such as nutrition have more upstream and diffuse impacts and are not the subject of these Cochrane Reviews which focus on 'just in time' prevention. In all reviews, authors recommended comparisons with multiple other interventions, not just one or two, to be included in the same trials. Mapping research questions against published systematic reviews may identify evidence-rich and evidence-poor areas of clinical practice which can help identify and prioritise directions and focus of future research. For example, one analysis demonstrated that over 50 per cent of published studies are designed without reference to existing systematic reviews of the evidence[42], contributing to wasted effort on researching practices for which the evidence is already well established. Compounding this problem are estimates of over 50 per cent of published research being seriously flawed in design or being unusable because of poor reporting, or both[43].

Limitations

We were selective in our approach and included only systematic reviews drawn from the Cochrane database because of their robust methodological approach. While we are aware of other systematic reviews in the area of wounds[44–46] we focused on Cochrane Reviews because of their explicit sections on implications for practice and research. However, the results of this review are inherently limited by not only the quality of the reviews, but also the quality of the evidence from the primary studies. Over the 12-year period these Cochrane reviews were published, methodological and reporting standards have improved. However, appraising the overall quality of the reviews using the AMSTAR 2 checklist has some limitations. First, the recommended scoring system marks reviews down where meta-analyses (Q11, 12 and 13) are not possible because of high heterogeneity among primary studies. Second, the tool does not assess the logic underpinning the choice of methods for conducting a particular review. Third, the tool does not specify which risk of bias instruments review authors should use to assess non-randomised trials and downgrades all such studies irrespective of differences in risk of bias.

Conclusions

The results of this meta-review suggest much uncertainty persists around the evidence to support many of the practices used in surgical wound care. To provide better health care, there is a compelling need for better evidence. Despite the availability of well-conducted systematic reviews, their contribution to clinical practice and research is ultimately determined by the quality of the primary studies. Clearly, there is a link between poor research and poor information, making clinical decision making difficult and perpetuating what may turn out in the future to be a significant burden of low-value care in surgical wound practice.

Conflict of interests

None.

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Pre-operative and post-operative recommendations to surgical wound care interventions: A systematic meta-review of Cochrane reviews

Supplemental material 1: Study characteristics for pre- and post-operative reviews

	Author (year)	No. studies (no. patients)	Population and surgery	Intervention	Comparator	Outcome (italics denotes outcomes identified in the review but no primary studies had data on these outcomes)	Quality/certainty of evidence
Pre-operative	Arrowsmith and Taylor (2014)	1 (102)	Scrub nurses prior to surgery	Removal of nail polish or rings	No removal	• number of bacterial colonising forming units	Not reported No GRADE
	Basevi and Lavender (2014)	Review 3 (1039) Surgical wound studies 1 (458)	Women in labour	Perineal shaving before birth	No shaving or clipping	• maternal fever • perineal wound infection • *perineal dehiscence* • *side effects (irritation)* • *need for resuturing* • maternal satisfaction • neonatal infection	Very low to low GRADE
	Dumville et al. (2015)	13 (2623)	Patients of any age undergoing clean surgery	Various skin antiseptics	Alternative antiseptics or soap	• surgical site infection (risk and rate) • *adverse events* • *quality of life* • *resource use*	Very low estimate or low GRADE
	Gurusamy et al. (2014)*	7 (614)	Patients undergoing liver transplantation	Various methods to prevent liver transplantation wound complications	Other practices	• mortality • retransplantation • *adverse events* • *graft rejection* • *intensive therapy stay* • *hospital length of stay* • *quality of life*	Very low GRADE
	Haas et al. (2018)	11 (3403)	Women undergoing caesarean section	Various vaginal cleaning solutions and practices prior to caesarean section	No preparation or use of saline	• post-op fever • post-op complications (endometriosis, wound infection, adverse events)	Moderate GRADE
	Hadiati et al. (2018)	11 (6234)	Women undergoing caesarean section	Various agents for skin preparation prior to caesarean section	Other practices	• surgical site infection • *endometriosis* • endomyometritis • *maternal mortality* • *repeat surgery* • skin irritation (or reaction) • hospital length of stay • *readmission for infection*	Very low to moderate GRADE
	Liu et al. (2017)	2 (291)	Carriers of *Staphlococcus aureus* undergoing cardiac surgery	Nasal decontamination with antiseptic or antibiotic	Placebo or no decontamination	• mortality • surgical site infection • other nosocomial infections • *adverse events* • *resource use* • *cost* • *quality of life*	Very low to low GRADE
	O'Kelly and Moore (2017)	0 (0)	Pregnant women	Antenatal education about potential perineal wounds	Other practices	• perineal wound healing • infection rate • re-attendance or re-admission • postnatal pain • quality of life • maternal bonding • negative emotional experiences	Not reported No GRADE
	Stewart et al. (2006)	35 (13 669)	Arterial reconstruction	Bathing/showering with antiseptic	Normal bath/shower	• Wound/graft infection	Jadad score**: M = 2.7 (0 = very poor, 5= rigorous) No GRADE
	Tanner et al. (2011)	14 (3638)	Adult patients undergoing surgery	Pre-operative hair removal, timing and method	No hair removal or different methods/ timing of hair removal	• wound complications including surgical site infection • *hospital length of stay* • *cost of hair removal*	Not high quality No GRADE
	Webster and Osborne (2015)	7 (10,157)	Adults and children undergoing any type of surgery	Bathing or showering with antiseptics	Bathing or showering without antiseptics	• mortality • surgical site infection • allergic reaction • hospital length of stay • readmission	Very low to high GRADE

(Continued on next page.)

Study characteristics for pre- and post-operative reviews (continued)

	Author (year)	No. studies (no. patients)	Population and surgery	Intervention	Comparator	Outcome (italics denotes outcomes identified in the review but no primary studies had data on these outcomes)	Quality/certainty of evidence
Post-operative	Dat et al. (2012)	Review 7 (347) Surgical wounds 2 (98)	Acute and chronic wounds	Aloe-vera dressing	Placebo	• wound healing • *wound appearance* • *adverse events (including infection)* • *cost* • *quality of life*	Poor quality trials No GRADE
	Dumville et al. (2016)	29 (5718)	Adults or children who had undergone surgical procedures	Various wound dressings	Alternative dressings or no dressings	• surgical site infection • scarring • acceptability • ease of removal • *pain* • *cost*	Very low to low GRADE
	Fernandez and Griffiths (2012)	Review 11 (3449) Surgical wounds 4 (1238)	People of all ages with a wound of any aetiology	Water, normal saline, tap water, distilled water, boiled water	No cleansing, procaine spirit, saline, isotonic saline	• infection • proportion of wounds that healed • rate of healing • pain • *discomfort* • patient satisfaction • *staff satisfaction* • *costs*	Poor quality trials No GRADE
	Heal et al. (2016)	14 (6466)	Wounds healing by primary intention	Topical antibiotics	Placebo	• surgical site infection • allergic contact dermatitis • time to healing • proportion of wound that had healed • patient satisfaction • *quality of life* • *cost for preventing infection*	Very low to moderate GRADE
	Jull et al. (2015)	Review 26 (3011) Surgical wounds 1 (50)	Acute or chronic wounds, women undergoing caesarean section or hysterectomy	Topical honey	Antiseptic washes followed by gauze or other practice	• wound healing time • adverse events • infection • *quality of life* • *costs*	Moderate GRADE
	Lethaby et al. (2013)	11 (572)	External bone fixation and pins	Various methods to clean or dress pin sites	Other practices	• pin site infection • pin site re-siting • external fixator apparatus removal • patient comfort • *patient acceptability* • *duration of treatment and overall treatment* • *cost* • *limb amputation* • *mortality*	Poor quality trials No GRADE
	Smith et al. (2013)	5 (159)	Patients with a surgical wound that required debridement	Various debridement methods	Other debridement, placebo or no debridement	• time to complete debridement • time to healing • proportion of wounds that healed completely • *infection* • hospital length of stay • *cost* • *patient satisfaction* • *quality of life*	Poor quality trials No GRADE
	Toon et al. (2015)	4 (280)	Primary closure of clear and clean contaminated surgical wounds	Early dressing removal (within 48 hours)	Delayed removal	• superficial surgical site infection • wound dehiscence • serious adverse events • *quality of life* • *time to return to work* • hospital length of stay • costs	Very low to low GRADE

(Continued on next page.)

Study characteristics for pre- and post-operative reviews (continued)

	Author (year)	No. studies (no. patients)	Population and surgery	Intervention	Comparator	Outcome (italics denotes outcomes identified in the review but no primary studies had data on these outcomes)	Quality/certainty of evidence
Post-operative	Toon et al. (2015)	1 (857)	Patients with a surgical procedure and had surgical closure of their wounds	Early post-operative bathing (dressing to be removed after 12 hours and normal bathing resumed)	Delayed post-operative bathing (dressing to be retained for at least 48 hours before removal and resumption of normal bathing)	• surgical site infection • *dehiscence* • *wound delayed morbidity (i.e. incisional hernia, keloid scar)* • *number of dressing changes* • *quality of life* • *hospital length of stay* • *number of hospital/home visits* • *antibiotics required*	Very low GRADE
	Vermeulen et al. (2007)	Review 3 (847) Surgical wounds 1 (619)	Contaminated or infected wounds	Topical silver	Local practice	• wound healing • *pain* • *days of wound infection* • adverse effects • systemic antibiotics • patient satisfaction • *quality of life* • *hospital length of stay* • *costs*	Not reported No GRADE
	Webster et al. (2014)	9 (785)	Skin grafts and wounds healing by primary intention	Negative pressure wound therapy	Other dressings	• mortality • surgical site infection • wound dehiscence • seroma/haematoma • failed skin graft • time to complete healing • re-operation • hospital length of stay • fracture blisters • *pain* • *quality of life* • *costs*	Unclear, poor quality trials No GRADE

Notes

GRADE = Grading of Recommendations Assessment, Development and Evaluation

*Gurusamy et al. focussed on both pre- and post-operative interventions.

**Jadad score = 3-point questionnaire using yes/no response for the following questions: Was the study described as randomised?, Was the study described as double blind? and Was there a description of withdrawals and dropouts? (Reference: Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJM, Gavaghan DJ et al. Assessing the quality of reports of randomized clinical trials: Is blinding necessary? Control Clin Trials 1998;17(1):1–12.)

Supplemental material 2: Recommendations for future research, including methodological issues

		Future research			Methodological issues									
		Further trials needed Y/N	Better quality research needed	More research based on 0collaboration with decision makers	Larger sample/ more sites	Powered sample	Allocation concealment	Blinding outcomes	Longer follow up	Appropriate statistical analysis	Inclusion of intention to treat analysis	Clearly defined interventions	Reporting by CONSORT statement	Include baseline comparability of groups
Surgical site infection – pre-op	Removal of nail polish and finger rings to prevent surgical site infection	Y	✓		✓	✓	✓	✓				✓		
	Routine perineal shaving on admission in labour	N												
	Pre-operative skin antiseptics for preventing surgical wound infections after clean surgery	Y		✓	✓									
	Methods of preventing bacterial sepsis and wound complications after liver transplantation	Y	✓										✓	
	Vaginal preparation with antiseptic solution before caesarean section for preventing postoperative infections	Y												
	Skin preparation for preventing infection following caesarean section	Y	✓		✓		✓	✓				✓		
	Nasal decontamination for the prevention of wound infections in *Staphylococcus aureus* carriers	Y	✓	✓	✓	✓			✓					
	Antenatal maternal education for improving postnatal perineal healing for women who have birthed in a hospital setting	Y			✓									
	Prevention of infection in arterial reconstruction	Y												
	Pre-operative hair removal to reduce wound infections	Y			✓	✓			✓				✓	✓
	Pre-operative bathing or showering with skin antiseptics to prevent wound infection	Y	✓		✓	✓			✓				✓	✓
Surgical site infection – post-op	Aloe vera for treating acute and chronic wounds	Y	✓		✓	✓	✓	✓			✓		✓	
	Dressings for the prevention of wound infections	Y	✓	✓	✓	✓							✓	
	Water for wound cleansing	Y	✓			✓	✓	✓	✓	✓			✓	✓
	Methods of preventing bacterial sepsis and wound complications after liver transplantation	Y	✓										✓	
	Topical antibiotics for preventing wound infections in wounds healing by primary intention	Y	✓				✓							
	Honey as a topical treatment for wounds	Y	✓		✓	✓	✓				✓		✓	✓
	Pin site care for preventing infections associated with external bone fixators and pins	Y	✓		✓	✓	✓							
	Topical silver for preventing wound infection	Y	✓	✓	✓	✓								
	Debridement for surgical wounds	Y	✓				✓	✓	✓				✓	
	Early vs. delayed dressing removal after primary closure of clean and clean-contaminated surgical wounds	Y												
	Early vs. delayed post-operative bathing or showering to prevent wound complications	Y	✓						✓					
	Negative pressure wound therapy for skin grafts and surgical wounds healing by primary intention	Y	✓		✓	✓								

Supplemental material 3: Recommendations for future research, including methodological issues

		Outcomes															
		Cost/economics	Different settings	Different populations/sub-group	Infection incidence	Patient experience/satisfaction	Product acceptability	Adverse events/effects	Quality of life	Mortality	Hospital length of stay	New comparisons	Valid wound measures	Time to heal	Wound infection measure	Wound complications	Pain
Surgical site infection – pre-op	Removal of nail polish and finger rings to prevent surgical site infection	✓			✓			✓	✓								
	Routine perineal shaving on admission in labour																
	Pre-operative skin antiseptics for preventing surgical wound infections after clean surgery	✓						✓				✓[1]					
	Methods of preventing bacterial sepsis and wound complications after liver transplantation							✓	✓	✓	✓						
	Vaginal preparation with antiseptic solution before caesarean section for preventing postoperative infections		✓									✓[2]			✓		
	Skin preparation for preventing infection following caesarean section							✓		✓	✓	✓[3]		✓		✓	
	Nasal decontamination for the prevention of wound infections in *Staphylococcus aureus carriers*	✓						✓	✓			✓[4]					
	Antenatal maternal education for improving postnatal perineal healing for women who have birthed in a hospital setting							✓		✓	✓	✓[5]					
	Prevention of infection in arterial reconstruction																
	Pre-operative hair removal to reduce wound infections										✓	✓[6]					
	Pre-operative bathing or showering with skin antiseptics to prevent wound infection																
Surgical site infection – post-op	Aloe vera for treating acute and chronic wounds	✓			✓			✓	✓								
	Dressings for the prevention of wound infections																
	Water for wound cleansing	✓	✓	✓		✓											
	Methods of preventing bacterial sepsis and wound complications after liver transplantation	✓						✓	✓	✓	✓						
	Topical antibiotics for preventing wound infections in wounds healing by primary intention	✓		✓					✓			✓[7]					
	Honey as a topical treatment for wounds	✓							✓			✓[8]					
	Pin site care for preventing infections associated with external bone fixators and pins			✓													
	Topical silver for preventing wound infection	✓							✓				✓				
	Debridement for surgical wounds	✓			✓	✓		✓	✓			✓		✓	✓		
	Early vs. delayed dressing removal after primary closure of clean and clean-contaminated surgical wounds			✓													
	Early vs. delayed post-operative bathing or showering to prevent wound complications	✓		✓					✓							✓	
	Negative pressure wound therapy for skin grafts & surgical wounds healing by primary intention	✓		✓							✓	✓[9]				✓	

Notes

1. Comparison: alcohol vs. aqueous solutions.
2. Intervention: care bundles.
3. Comparison: iodine versus chlorhexidine, night versus day of surgery.
4. Intervention: consider harm of intervention antibiotic resistance.
5. Qualitative outcomes.
6. Hair removal using clippers v razors v depilatory cream. Different times prior to surgery; Different settings for hair removal (operating theatre, anaesthetic room, ward, patient's home).
7. Topical antibiotics alone versus systemic antibiotics alone versus a combination of systemic and topical antibiotics in preventing surgical site infections.
8. Honey versus other dressing.
9. Different types of negative pressure wound therapy and different pressures.

Supplemental material 4: Quality assessment of surgical site infection reviews using the A MeaSurement Tool to Assess Systematic Reviews 2 (AMSTAR 2) checklist (n = 22)

	Author (year)	1. Question and inclusion	2. Protocol	3. Study design justification	4. Comprehensive search	5. Study selection	6. Data extraction	7. Excluded studies justification	8. Included studies details	9. Risk of bias (RoB)	10. Funding sources	11. Statistical methods	12. RoB on meta-analysis	13. RoB in individual studies	14. Explanation for heterogeneity	15. Publication bias	16. Conflict of interest	Rating
Pre-operative (n = 11)	1. Arrowsmith and Taylor (2014)	Y	Y	N	PY	Y	Y	Y	Y	Y	N	NMC	NMC	Y	Y	NMC	Y	Moderate
	2. Basevi and Lavender (2014)	Y	Y	N	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
	3. Dumville et al. (2015)	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Low
	4. Gurusamy et al. (2014)*	Y	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
	5. Haas et al. (2018)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
	6. Hadiati et al. (2018)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
	7. Liu et al. (2017)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	NMC	NMC	Y	Y	NMC	Y	High
	8. O'Kelly and Moore (2017)	Y	Y	N	Y	Y	Y	Y	NSI	Y	Y	NMC	NMC	NSI	NSI	NMC	Y	High
	9. Stewart et al. (2006)	Y	PY	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Critically low
	10. Tanner et al. (2011)	Y	Y	N	Y	Y	Y	Y	PY	Y	Y	Y	Y	Y	Y	N	Y	Low
	11. Webster and Osborne (2015)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Low
	Percentage of pre-op reviews meeting each criterion	**100**	**91**	**9**	**73**	**100**	**100**	**100**	**90**	**100**	**73**	**100**	**100**	**90**	**100**	**50**	**100**	
Post-operative (n = 11)	12. Dat et al. (2012)	Y	Y	N	PY	Y	Y	Y	Y	Y	N	NMC	NMC	Y	Y	NMC	Y	Moderate
	13. Dumville et al. (2016)	Y	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
	14. Fernandez and Griffiths (2012)	Y	Y	N	PY	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Low
	15. Gurusamy et al. (2014)*	Y	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
	16. Heal et al. (2016)	Y	Y	N	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
	17. Jull et al. (2015)	Y	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
	18. Lethaby et al. (2013)	Y	Y	N	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
	19. Smith et al. (2013)	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	NMC	NMC	Y	Y	NMC	Y	High
	20. Toon et al. (2015)	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	High
	21. Toon et al. (2015)	Y	Y	Y	PY	Y	Y	Y	Y	Y	Y	NMC	NMC	Y	Y	NMC	Y	High
	22. Vermeulen et al. (2007)	Y	PY	N	Y	Y	Y	Y	PY	Y	Y	NMC	NMC	Y	Y	NMC	Y	High
	23. Webster et al. (2014)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
	Percentage of post-op reviews meeting each criterion	**100**	**92**	**50**	**33**	**100**	**100**	**100**	**91**	**100**	**67**	**100**	**100**	**100**	**100**	**88**	**100**	
	Percentage of all reviews meeting each criterion	**100**	**91**	**26**	**57**	**100**	**100**	**100**	**91**	**100**	**65**	**100**	**100**	**95**	**100**	**67**	**100**	

Notes

- Bolded table headings denote essential A MeaSurement Tool to Assess Systematic Reviews 2 checklist domains.
- Y = yes, PY = partial yes, N = no, NSI = no studies identified, NMC = no meta-analysis conducted.
- Bolded items are A MeaSurement Tool to Assess Systematic Reviews 2 (AMSTAR 2) checklist critical domains.
- Reviews with NSI and or NMC in their items cell were excluded from the summary percentage.

* Gurusamy et al., 2014 is the same review, replicated as both pre- and post-operative.

Peer-reviewed article

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Environmental stressors perceived by patients in the surgical intensive care unit and their level of satisfaction with nursing care

Abstract

Purpose: The purpose of this study was to determine environmental stressors perceived by patients in the surgical intensive care unit and their level of satisfaction with nursing care.

Design: A descriptive cross-sectional study design was used in this study.

Methods: This study was conducted between January 2019 and June 2019 with 120 patients who were hospitalised in the surgical intensive care unit. Data collection was via a patient information form, the Intensive Care Unit Environmental Stressor Scale (ICUESS) and the Experiences of Nursing Care Scale (ENCS) component of the Newcastle Satisfaction with Nursing Scales (NSNS).

Findings: The mean ICUESS score was found to be 76.30 ±11.18. The main stressors perceived by the patients in the surgical intensive care unit were being in pain, being thirsty and sleeplessness. The ENCS mean score was 81.05 ±9.03.

Conclusion: The mean score of the ICUESS of patients was moderate and the mean score of the ENCS was good. There was a statistically significant, negative and moderate correlation between the ICUESS score and the ENCS score.

Keywords: surgery, nursing care, intensive care unit, patient satisfaction, environmental stressor

Introduction

Being sick and being hospitalised causes anxiety and stress in the individual[1,2]. Patients in the intensive care unit (ICU) experience more of this anxiety and stress[3] due to the physical environment of the ICU, the technological devices used, the way the ICU functions and the special treatment methods applied. While technological developments increase treatment opportunities and the quality of life for patients, environmental stressors can adversely affect the quality of life[4]. The opportunities for diagnosis, follow-up and treatment of life-threatening diseases have increased, thanks to developments and changes in health care technology, but patients have been exposed to negative environmental stressors during their stay in intensive care[1]. Stressors in the intensive care environment are defined as physical, physiological and environmental[5,6]. It is known that environmental factors play a large role in increasing or decreasing the patient's stress[4,7].

Environmental stressors that patients frequently encounter are: invasive interventions, deterioration of the

perception of day/night, extreme heat or cold, fear/anxiety, being separated from the family, inability to fulfil their role in the family, loneliness, lack of privacy, disturbing images and smells[2,6,8–10]. Nurses need to identify the stressors perceived by patients, take precautions against the stressors, evaluate patient reactions to stressful situations and plan care accordingly[1,4,11].

Excessive noise, light, excessive mobility or the opposite, inactivity and monotonous sounds in the intensive care unit cause psychosocial problems (such as sensory deprivation or overload) in patients[5,12]. Health care professionals knowing the environmental factors that cause stress in patients treated in the ICU and taking necessary precautions in this regard will positively affect the healing process of the patients[12].

It is recommended that environmental stressors in the ICU are identified in order to minimise them (for example, by providing patient comfort and privacy, reducing light and noise and relieving pain), and to enable patients to cope with the stress factors they experience[4]. Also, it is stated that patients having bad experiences in the ICU reduces their satisfaction with nursing care[11]. Accounting for the factors affecting satisfaction with nursing care enables patients to adapt to treatment, feel valued and increase their health-enhancing behaviors[13]. Determining the environmental stressors perceived by patients in the intensive care unit and their effects on the patients is important in terms of reducing the negative effects of the ICU and planning initiatives and nursing care to create an appropriate environment. This research was conducted to determine the environmental stressors perceived by patients in the surgical ICU and their satisfaction levels concerning nursing.

The following research questions were developed.

1. What are the environmental stressors perceived by patients in the surgical intensive care unit?
2. What is the level of satisfaction of patients in terms of nursing in the surgical care unit?
3. Do environmental stressors affect patients' satisfaction with nursing care?

Methods

Design

In this descriptive cross-sectional study, the sample comprised 120 patients hospitalised in surgical ICUs between January and June 2019. The cardiovascular surgery ICU had an area of 170 m^2 and a total of nine beds in ward style. The general surgery ICU had an area of 46 m^2 and a total of four beds in ward style.

Study population

Patients who were over the age of 18, had no communication problems, were conscious, had been in the ICU for 24–72 hours and volunteered to participate in the study were included in the scope of the research. As delirium develops after 72 hours in the ICU, patients whose stay exceeded this period were not included in the study.

Data collection

Data was collected using a personal information form, the Intensive Care Unit Environmental Stressors Scale (ICUESS) and the Newcastle Satisfaction with Nursing Scales (NSNS).

Personal information form

The form was prepared by the researcher as a result of the literature review and consisted of 25 questions about sociodemographic characteristics and illness.

Intensive Care Unit Environmental Stressor Scale (ICUESS)

This tool was developed by Ballard[14] to identify the stressors perceived by patients treated in intensive care units and its validity and reliability in Turkish were determined by Aslan and Cinar[15]. The scale is a four-point Likert-type scale consisting of 42 items. The minimum score to be obtained from the scale is 42 and the maximum is 168 points. Higher scores indicate higher rates of patient exposure to environmental stressors[12,15,16]. In the study conducted by Aslan and Cinar the Cronbach alpha coefficient was found to be 0.94[14] whereas in this study the Cronbach alpha coefficient was found to be 0.72.

Newcastle Satisfaction with Nursing Scale (NSNS)

This tool was developed by Thomas et al.[17] and its validity and reliability in Turkish was conducted by Uzun (2003)[18]. The NSNS consists of two scales – the Experiences of Nursing Care Scale (ENCS) and the Satisfaction with Nursing Care Scale (SNCS). These scales can be applied together or separately. In this research, only the ENCS was applied as the items in this scale were considered to be more suitable for intensive care patients. The ENCS is a seven-point Likert-type scale consisting of 26 items. After the scores of all items in the scale are added, they are converted to 100 and an evaluation is made over 0 to 100 points. A total score of 100 indicates that the experience of nursing care is at the best level[18,19]. In the study conducted by Uzun the Cronbach alpha coefficient was found to be 0.75[18]. In this study, the Cronbach alpha coefficient was found to be 0.89.

Implementation of research

Between January and June 2019, patients who met the research criteria were informed about the purpose of the research. Researchers collected data using face-to-face interviews after the patients were taken from the ICU to the clinic (i.e. when patients completed their ICU journey). Interviews lasted an average of 15 minutes.

Data analysis

The data obtained from the research was analysed using the software SPSS for Windows. The results were expressed as number (percentage), mean and standard deviation (±sd). Since the data did not show normal distribution, continuous measurements were evaluated with nonparametric tests; Spearman correlation, Mann Whitney U and the Kruskal-Wallis test were used. The value of P<0.05 was considered the statistical significance limit.

Ethical considerations

The research was approved by the Medical Research Ethics Committee. Written permission was obtained from the institution where the study was carried out. Informed consent was obtained from all individual participants included in the study. This study was performed according to the Helsinki Declaration.

Results

Patient descriptive characteristics

The average age of patients participating in the study was 58.24±13.53 (min. 18, max. 75); 65.8 per cent of the patients were male, 79.2 per cent were married, 60.8 per cent were literate or graduated from primary school, 79.2 per cent had a chronic disease, 75.8 per cent were taking medication (e.g. analgesics and antihypertensives for chronic disease), and 60.8 per cent had not been admitted to the ICU before. Regarding type of ICU, 63.3 per cent of patients were in the cardiovascular surgery ICU and 46.7 per cent in general surgery ICU. The average length of stay in the ICU was 26.96±10.67 hours and 69.1 per cent of patients were connected to mechanical ventilation with the average period of mechanical ventilation being 6.97±3.17 hours. Relatives of 95.0 per cent of patients came to visit the patient in the ICU. The treatment and care received was evaluated as good by 55.8 per cent of patients and as very good by 41.7 per cent.

ICUESS and ENCS scores

Table 1 shows the mean scores for stressors on the ICUESS. The total average ICUESS score was 76.30±11.18 and the top three stressors perceived by participating patients were pain (2.94±0.99), not being able to drink water (2.79±1.32) and not being able to sleep (2,75±1,18).

No statistically significant difference was found between any of the descriptive characteristics and the total ICUESS or ENCS score (p>0.05). (See Table 2.)

While no statistically significant difference was found between ICUESS or ENCS scores and any of the patient characteristics (p>0.05), there was a statistically significant difference between the clinic types and the ICUESS total score. The total ICUESS score averages of the patients in the cardiovascular surgery ICU were higher than those of patients in the general surgery ICU (p<0.05). (See Table 3.)

A moderate and statistically significant negative correlation was found between the ICUESS total score and ENCS total score (r_s= -0.376, p=0.001). A statistically significant and rather weak negative relationship was found between patient age and ENCS total score (rs= -0.190, p=0.038). No statistically significant correlation was found between either length of stay in the ICU or duration of mechanical ventilation and the total scores of ICUESS and ENCS (p>0.05). (See Table 4.)

Discussion

Nursing care involves treating the patient as a whole with their physical, psychological and social aspects. However, since the condition of patients in the ICU is critical and requires urgency, physiological care can be prioritised and psychological care of patients can be ignored[20]. However, determining the presence and level of influence of stressors that can cause anxiety, fear, depression and negative health behaviors in the care and rehabilitation of patients during the intensive care process is important in determining care need[20,21].

In this study, the average ICUESS score of patients was 76.30±11.18. This result shows that the participating patients' perception of stressors was below average. Intensive care patients' low perception of stress may be due to an inability to remember the surrounding events clearly, not wanting to remember the experience they went through and not wanting to come across as a complaining patient[16].

The averages of total ICUESS scores in similar studies were examined and found to be 69.26±21.84 by Tezcan Karadeniz and Kanan[3], 79.9±31.3 by Candan Donmez et al.[16], 86.20±15.61 by Hweidi and Nizamli[10], 86.70±2.73 by Yaman Aktaş et al.[6], 110.22±15.64 by Şahin and Köçkar[20] and 128.32±16.37 by Gencer and Karakoç-Kumsar[1].

Table 1: Mean scores for stressors on the Intensive Care Unit Environmental Stressor Scale (ICUESS) as rated by patients

	Stressors (1–4 points)	Mean±SD
1	Being tied down by tubes	2.47±1.20
2	Not having nurses introduce themselves	1.64±0.93
3	Having nurses be in too much of a hurry	1.09±0.31
4	Being thirsty	2.79±1.32
5	Having your blood pressure taken often	1.01±0.18
6	Uncomfortable bed or pillow	1.45±0.79
7	Hearing the telephone ring	1.26±0.68
8	Frequent physical exams by doctors or nurses	1.05±0.31
9	Having strange machines around you	1.67±0.88
10	Feeling nurses are watching the machines closer than watching you	1.07±0.34
11	Hearing the buzzers and alarms from the machinery	1.53±0.87
12	Nurses and doctors talking too loudly	1.56±0.95
13	Having to wear oxygen	2.00±1.04
14	Missing your husband or wife	2.73±1.09
15	Not having treatment explained to you	2.29±1.11
16	Hearing you heart monitor alarm go off	1.49±0.85
17	Having nurses constantly doing things around your bed	1.06±0.25
18	Having tubes in your nose or mouth	2.28±1.18
19	Not knowing what time it is	2.05±1.30
20	Hearing other patients cry out	2.54±1.25
21	Having men and women in the same room	1.30±0.74
22	Only seeing family and friends for a few minutes each day	1.19±1.11
23	Not knowing when to expect things to be done	2.66±0.50
24	Being awakened by nurses	1.76±0.93
25	Unfamiliar and unusual noises	1.17±0.52
26	Watching treatment being given to other patients	2.00±1.10
27	Having to look at the pattern of tiles/ holes in the ceiling	2.53±1.22
28	Not being able to sleep	2.75±1.18
29	Not being able to move your hands or arms because of intravenous (IV) lines	1.86±0.62
30	Being aware of unusual smells around you	1.08±0.37
31	Having lights on constantly	2.54±1.18
32	Being in pain	2.94±0.99
33	Seeing intravenous (IV) bags over your head	1.11±0.41
34	Being stuck with needle	2.09±0.79
35	Not knowing where you are	2.03±1.32
36	Having nurses use words you cannot understand	1.08±0.33
37	Not being in control of yourself	1.14±0.43
38	Not knowing what day it is	2.23±1.34
39	Being bored	2.53±1.24
40	Having no privacy	2.07±1.15
41	Being cared for by unfamiliar doctors	1.03±0.22
42	Being in a room which is too hot or cold	2.02±1.23
Total score		76.30±11.18

Table 2: The average distributions of Intensive Care Unit Environmental Stressor Scale (ICUESS) and Experiences of Nursing Care Scale (ENCS) scores according to the descriptive characteristics of the patients

Patient characteristics	n (%)	ICUESS		ENCS	
		X± SS	Statistical comparison	X± SS	Statistical comparison
Gender			Z= -0.244 P=0.808		Z= -1.453 P=0.146
· female	41 (34.2)	80.75±8.94		78.00±10.41	
· male	79 (65.8)	81.20±9.13		75.41±11.52	
Marital status			Z= -1.616 P=0.106		Z= -1.461 P=0.144
· married	95 (79.2)	81.87±8.33		75.38±10.36	
· single	25 (20.8)	77.91±10.94		79.76±13.54	
Educational status			KW=9.519 P=0.059		KW=5.551 P=0.235
· not literate	15 (12.5)	80.03±5.44		81.66±11.43	
· primary school	73 (60.8)	80.83±9.45		76.21±10.89	
· secondary school	12 (10.0)	87.40±6.29		72.83±8.61	
· high school	13 (10.8)	77.68±11.25		75.00±12.69	
· university	7 (5.8)	80.84±6.46		74.00±13.65	
Occupation			KW=4.073 P=0.396		KW=2.830 P=0.587
· housewife	37 (30.8)	80.99±9.17		77.27±10.32	
· officer	4 (3.3)	79.53±3.65		79.75±11.92	
· worker	38 (31.7)	81.56±10.12		74.81±10.95	
· retired	15 (12.5)	83.00±6.52		75.40±14.28	
· other	26 (21.7)	79.50±9.20		72.07±11.17	
Smoking status			KW=1.652 P=0.408		KW=1.794 P=0.408
· still smoking	14 (11.7)	83.83±6.66		73.42±7.25	
· never smoked	46 (38.3)	80.08±8.09		77.73±12.24	
· quitted smoking	60 (50.0)	81.14±10.11		75.86±11.06	
Place of residence			KW=1.273 P=0.529		KW=0.707 P=0.702
· province	62 (51.7)	80.31±10.33		76.75±11.37	
· district	37 (30.8)	82.92±4.96		72.02±10.51	
· village	21 (17.5)	79.93±10.29		77.19±12.05	
Household members			KW=4.116 P=0.249		KW=5.305 P=0.151
· patient alone	16 (13.3)	78.46±12.41		78.62±15.44	
· patient and spouse	57 (47.5)	82.04±8.21		74.28±10.64	
· patient and children	12 (10.0)	77.88±7.45		81.91±10.24	
· patient and spouse and children	35 (29.2)	81.71±8.93		76.60±9.54	

Notes: Z= Mann Whitney U, KW= Kruskal-Wallis Test,

Table 3: The average distributions of Intensive Care Unit Environmental Stressor Scale (ICUESS) and Experiences of Nursing Care Scale (ENCS) scores according to patient characteristics and clinic type

Characteristics	n (%)	ICUESS		ENCS	
		X± SS	Statistical comparison	X± SS	Statistical comparison
Clinic			Z= -2.169 **P=0.030***		Z= -0.594 P=0.553
· cardiovascular	76 (63.3)	77.90±11.00		81.80±7.93	
· general surgery	44 (36.7)	73.52±11.05		79.75±10.64	
Chronic disease			Z= -0.469 P=0.639		Z= -1.746 P=0.081
· yes	95 (79.2)	76.56±11.17		80.75±8.35	
· no	25 (20.8)	75.28±11.38		82.19±11.39	
Taking medication			Z= -0.098 P=0.922		Z= 1.35 P=0.174
· yes	91 (75.8)	76.28±11.15		80.82±8.58	
· no	29 (24.2)	76.34±11.47		81.75±10.44	
Previous hospitalisation			Z= -0.847 P=0.397		Z= -0.663 P=0.508
· yes	103 (85.8)	76.67±11.17		81.50±8.17	
· no	17 (14.2)	74.00±11.26		78.31±13.08	
Previous admission to ICU			Z= -1.167 P=0.243		Z= -0.608 P=0.543
· yes	47 (39.2)	74.76±11.48		81.92±7.85	
· no	73 (60.8)	77.28±10.94		80.49±9.72	
Oral nutritional status			Z= -0.219 P=0.827		Z= -0.261 P=0.794
· yes	110 (91.7)	76.35±11.12		81.01±9.34	
· no	10 (8.3)	75.70±12.41		81.48±4.70	
Experienced mechanical ventilation before			Z= -0.245 P=0.248		Z= -0.162 P=0.334
· yes	83 (69.1)	77.10±10.89		80.33±9.69	
· no	37 (30.8)	74.48±11.73		82.65±7.19	
Had visitors			Z= -0.849 P=0.396		Z= -0.139 P=0.890
· yes	114 (95.0)	76.54±11.25		81.00±9.20	
· no	6 (5.0)	71.66±9.22		82.05±5.22	

Note: Z= Mann Whitney U

Table 4: The relationship between patient age, length of stay in ICU, duration of mechanical ventilation, ICUESS total score and ENCS total score

	ICUESS total score (76.30±11.18)		ENCS total score (81.05±9.03)	
	r_s	P	r_s	P
ICUESS total score			-0.376	**0.001***
Age	0.150	0.101	-0.190	**0.038***
Length of stay in ICU (hours)	0.058	0.528	-0.103	0.264
Duration of mechanical ventilation (hours)	0.098	0.379	0.078	0.482

Notes: r_s= Spearman'sRho, *p<0.05

These results show that patients receiving treatment in the ICU perceive different levels of stress. The difference between studies is thought to be due to the fact that studies have been conducted in different intensive care units and involved patients with different diagnoses.

In this study, no statistically significant relationship was found between the ICUESS total score and any of the descriptive patient characteristics (age, gender, marital status, educational status, occupation, smoking status, place of residence and household members). There was also no statistically significant relationship between the ICUESS total score and other characteristics investigated (whether or not the patient had chronic disease, took medication, had previously been hospitalised, had previously been admitted to the ICU, could take oral nutrition, had previous experience of mechanical ventilation or had visitors). In addition, no statistically significant relationship was found between ICUESS total score and length of stay in ICU or duration of mechanical ventilation. In contrast, in Şahin and Köçkar's study on the environmental stressors perceived by patients hospitalised in the surgical ICU[20], the researchers found that age (specifically the 31–50 age range), educational status, marital status, absence of chronic illness, length of stay in the ICU and patient status regarding previous admission to the ICU significantly affected the scale's average score. Research into cardiovascular surgery ICUs conducted by Yaman Aktaş et al.[6], determined that age, gender, marital status and educational status did not significantly affect the average total score.

In this research, the averages of the total ICUESS score of the patients in the cardiovascular surgery ICU were higher than for the patients in the general surgery ICU (p<0.05). In cardiovascular surgery patients, the symbolic meaning and importance of the heart and the fear of intervention with the heart cause fear of death, while the process of being connected to and disconnected from the mechanical ventilator, implantable cardiac defibrillators and incisions for catheters and drains increase the risk of anxiety[22]. The difference between the two clinics is thought to be due to these reasons.

In this study, the stressor with the highest mean score was 'being in pain'. This is consistent with most other similar studies[3,6,8,16,20,23]. Factors that can cause pain in patients include the disease requiring intensive care, various invasive and non-invasive interventions, treatment and care initiatives, aspiration processes, dressing changes, prolonged inactivity and aspects of surgery – the operation area, its duration, characteristics and the type of incision – as well as patient transfer. Frequent pain is expressed by many patients in intensive care from mild to severe[21,24]. Sleep disturbance, anxiety and delirium may develop in patients due to increased release of endogenous catecholamine following painful inductions[6]. Pain is an important factor of suffering, affects the quality of life and jeopardises the physical and psychosocial state[21]; therefore, accurate diagnosis of pain by intensive care nurses and ensuring effective pain management can be useful in providing quality care[6].

The stressor with the second highest mean score was 'not being able to drink water'. Thirst was perceived by patients as the most important stressor in the study by Gultekin et al.[9] conducted in the general surgery and anesthesia and reanimation intensive care unit. In Sahin and Kockar's study[20] and the study by Candan Donmez et al[16], thirst was perceived as the third most important stressor. In the study of Zaybak and Cevik[2], thirst was

determined as a low-level stressor[2]. It is thought that thirst is among the most highly rated stressors because patients hospitalised in the intensive care unit may be dehydrated due to the treatment process[16].

In this study, the stressor with the third highest mean score was 'not being able to sleep'. Insomnia was found to be the second most important stressor by Yaman Aktas et al.[6], and the fourth most important stressor by Candan Donmez et al.[16]. Factors that cause sleep disorders in patients include type and severity of the underlying disease, the pathophysiology of the acute disease, a patient's sleep habits, pain, exposure to light for 24 hours, noise, nursing interventions, unpleasant odors, mechanical ventilation incompatibility, aspiration, lying in a fixed position, loss of privacy, being away from the family and fear of death[1,25]. The noise level in the intensive care unit is twice that recommended by international guidelines[26]. Since sleep deprivation may prolong illness, delay recovery and cause confusion in intensive care patients, it is important to plan interventions to avoid sleep deprivation[6]. Given the stronger influence of environmental factors, the use of earplugs or sleep masks is recommended[26].

The ENCS total score in this study was 81.05±9.03 and the satisfaction was assessed as high. In many studies that evaluated the level of satisfaction of patients hospitalised in different clinics, it was found that patients were moderately to highly satisfied with the nursing care they received[19,27,28]. In this study, no statistically significant correlation ($p>0.05$) was found between the total ICUESS score and either length of stay in the intensive care unit or the duration of being on the mechanical ventilation. Similarly, Dias et al. found that the length of stay in the ICU did not significantly affect the score of environmental stressors[8]. It has been suggested that prolonged stay in the intensive care unit may reduce patients' rating of environmental stressors as patients become accustomed to procedures and the intensive care environment[20].

This study found that environmental stressors in the ICU negatively affected the level of satisfaction of patients with nursing care. Similarly, in the study conducted by Zengin et al.[11], it was found that as the stressors increased the patients' perception of their ICU experience was negatively affected and satisfaction with nursing care decreased. ICUs provide services for treating individuals with medical and surgical diseases and contain a large number of technological devices. Patients in ICU face many physical and psychosocial stressors both because of the environment they are in and because of the surgical procedure they have had[21]. As a result, ICU patients face problems such as sleep disturbances, thirst, pain, inability to distinguish day and night, impaired perception, anxiety and fear[2,20]. Therefore, we think that as the environmental stressors perceived by the patient increase, their satisfaction with nursing care decreases.

Identifying environmental stressors in intensive care patients and making plans to eliminate those stressors will contribute positively to the treatment process.

Limitations

The results of this study cannot be generalised to the whole surgical ICU patient population in Turkey, as the study was conducted in only one state hospital.

Conclusions

This study found that the environmental stressor levels perceived by patients in the surgical ICU were below average. Being in pain was the stressor with the highest mean score, followed by not being able to drink water and not being able to sleep. Patient satisfaction levels with nursing care were found to be high. It was determined that environmental stressors in the intensive care unit negatively affected the satisfaction levels of patients with nursing care.

In line with these results, it is recommended that nurses thoroughly evaluate potential sources of patient stress in the ICU and take these stressors into account when arranging the patient's environment.

Also, nurses should constantly evaluate the level of satisfaction of patients with nursing care and make necessary plans to increase satisfaction.

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Qualifying thirst distress in the acute hospital setting – validation of a patient-reported outcome measure

Abstract

Objective: This study aims to examine validity and sensitivity of two visual analogue scales (VASs), measuring thirst intensity and thirst distress, and compare them with a validated thirst discomfort scale (TDS).

Methods: This is a non-interventional, prospective and cross-sectional study. Researchers recruited 161 patients from an acute surgical hospital, who were identified at time of interaction as fasting. Data was collected using a questionnaire, which included the TDS. Criterion validity and construct validity was tested for the two VASs. Sensitivity was assessed based on the amount of time fasting from solid foods or fluids.

Results: Results showed the VAS for thirst intensity, the VAS for thirst distress and the average of the VAS scores correlated with the TDS (ρ=0.66, 0.81 and 0.72 respectively, all $p<0.001$).

Conclusions: Our findings suggest that the VAS is a valid and sensitive patient-reported outcome measure for thirst distress in fasting patients.

Keywords: fasting, thirst distress, thirst discomfort scale, visual analogue scale.

Background

Fasting is often required before investigations and procedures needing sedation or anesthesia[1]. There is strong (Level A) evidence to support reduced fasting times, allowing the safe consumption of solids up to six hours, and clear fluids up to two hours prior to a procedure requiring anaesthesia[1]. These recommendations have been adopted within local governing organisations[2] but implementation into clinical practice has been slow. The prevalence of prolonged fasting, beyond six hours for solids and two hours for fluids, remains high within the hospital setting[3]. It has been identified that complex historical, cultural and systemic barriers within the hospital system are the main obstacles to implementing evidence-based fasting practices. A medical system where junior doctors and nurses feel unable to challenge surgeon instructions and where there is lack of connectivity between surgical, ward and diet ordering systems as well as a tradition of 'fasting from midnight' means that the majority of patients will be asked to fast for prolonged periods[4]. Similarly, repeated and extended fasting is experienced when procedures are rescheduled or cancelled[3,5,6]. Current data shows fasting for longer than recommended times not only leads to physiological discomfort, such as thirst, dry mouth and dehydration, but also impacts a patient's psychological status causing irritability and anxiety[6-8]. Previous qualitative research has shown high levels of distress in patients fasted for extended periods of time. This is likely due to the physiological response but also due

to the emotional significance of food and a consequent lack of autonomy[8]. The hospital system leaves patients with little internal control, where food is often seen as one of the few aspects of care over which patients and families have control. This relationship with food is significant as food and feeding is symbolic of caregiving and return to health[8].

Moreover, the detrimental changes in physiological function due to prolonged fasting can be seen within 24 hours through increased insulin resistance and reduced muscle function[9]. Extended or repeated fasting can further lead to hospital-acquired malnutrition[10]. The catabolic sequelae related to malnutrition negatively impact risk of infection[11], complications rates[12] and length of stay[13] while overall malnutrition increases the risk of mortality[13].

Thirst is a common subjective symptom among fasting patients driven by physiological responses to hypovolaemia[14]. Thirst is exacerbated by extended peri-procedural fasting together with increased anxiety about the upcoming procedure[15,16]. The presence of thirst has been shown to have a negative impact on quality of life[17] and may detract from the patient's experience. Previous qualitative research indicates that fasted participants describe overwhelming thirst and dry mouth as the most difficult aspect of fasting[8]. As such, it is important to be able to measure thirst to assess the level of fasting-related distress and implement management strategies to reduce thirst-related distress. This can be done by using a valid patient-reported outcome measure (PROM). PROMs provide the patient's perspective by recording feedback directly without input from other health professionals[18,19]. Health care systems are beginning to recognise the importance of patient-reported outcomes as a measure of quality of care and an integral part of clinical governance[20].

One research team from Brazil developed and validated a thirst discomfort scale (TDS) determining perioperative thirst discomfort based on a sample of 70 patients[15]. The TDS involves quantifying seven aspects of thirst on a three-point Likert scale (Table 1). It has been used to measure change in thirst discomfort following implementation of interventions aimed to reduce thirst in heart failure[21] and haemodialysis[22] populations. This tool is useful within research but may have limited use in a busy hospital setting as a part of usual care. The length of the questionnaire can make data collection and analysis time consuming in the clinical setting and may be seen as a perceived barrier to implementing it as a part of a pre-operative assessment tool. Another study by Puntillo et al.[16] also measured thirst intensity and distress in a randomised study assessing the impact of interventions to improve mouth dryness and distress in intensive care patients undergoing procedures. Puntillo et al.[16] used two visual analogue scales (VASs) measuring intensity and distress related to thirst prior to fasting for procedures and post-randomisation based on intervention versus control[16]. While the VAS has been validated to measure different outcomes including quality of life[23] and pain[24], specific use of VASs for thirst intensity and thirst distress has not been validated.

Aim

The aim of the current study is to investigate the criterion validity, construct validity and sensitivity of the two VAS questions relating to thirst intensity and thirst distress (as shown in Table 1) in a cohort of fasting adult inpatients at a quaternary referral hospital in Sydney, Australia, and validate it against the already validated TDS.

It is hypothesised that the two VAS questions will correlate with the TDS; that the two VAS questions will correlate with each other; and that fasting-related distress will be proportional to the length of time spent fasting.

Methods

Study design

The study is a non-interventional prospective cross-sectional study applied to a random sample of adult inpatients required to fast. The study was conducted within a quaternary hospital in Sydney, Australia, across surgical and non-surgical wards during a six-week period from August to October 2019. The study was approved by the Ethics Review Committee of Sydney Local Health District, Royal Prince Alfred Hospital (Protocol Number X19-0158).

Participants

Patients were deemed eligible for inclusion if they met the following inclusion criteria: more than 18 years old, fasting at the time of interaction and able to communicate in English. Patients were excluded if there was a history of dementia, cognitive impairment or unconsciousness, contact/isolation precautions, clinical instability, a diagnosed eating disorder or implemented nutritional support.

Initial study recruitment was undertaken by the dietitian or dietitian assistant seeing the patient during routine malnutrition screening and/or screening for potential implementation of nutrition interventions. Where patients were happy to be involved, one member of the research team (LY) approached the patient for written consent.

Table 1: Thirst distress scale (TDS) and visual analogue score (VAS) questions

Tool	Aspect to be quantified / questions	Ranking scale
Thirst distress scale (TDS)	1. My mouth is dry 2. My lips are dry 3. My tongue is thick 4. My saliva is thick 5. My throat is dry 6. I have a bad taste in my mouth 7. I want to drink water	0 = not bothered 1 = slightly bothered 2 = very bothered
Visual analogue scales (VASs)	How intense is your thirst at the moment?	0–10 where 0 means not thirsty at all and 10 means intense thirst.
	How distressing (or bothersome) is your thirst is at the moment?	0–10 where 0 means not distressed at all and 10 means extreme distress.

Data collection

The questionnaire consisted of eleven questions. Two questions asked patients how long they had been fasting from solids and fluids, seven questions were directly from the TDS validated tool[15], and the two VAS questions assessed the thirst intensity and thirst distress levels. Additional information was collected by the recruiting research team member (LY), noting if the patient was receiving intravenous (IV) fluids at the time of the visit. No demographic, disease-related or procedure-related information was collected and all data was non-identifiable.

Measurements

The length of fasting time was reported in hours. The seven items of the TDS were rated on a three-point Likert scale, ranging from 'not bothered' (score of 0) to 'very bothered' (score of 2). The total score ranged from 0 to 14, with higher scores indicating a more intense thirst-related discomfort as per the validated tool[15]. For the VAS questions, patients were asked to rate their level of thirst intensity and level of distress related to their thirst on a scale where the left end (0 cm) indicated no thirst at all and the right end (10 cm) indicated worst possible thirst. The VAS scores were reported as the thirst intensity score and the thirst distress score; an average VAS score, which was the average of the thirst intensity and the thirst distress scores, was also calculated.

Data analysis

All data were entered directly into RedCap and assessed using SPSS (version 25, SPSS Inc., Chicago, Illinois, USA). The Kolmogorov–Smirnov test was used to assess normality of data; variables that didn't follow a normal distribution were demonstrated as median with interquartile range (IQR).

Criterion validity of the two VASs was measured by calculating the Spearman correlation coefficient (ρ) for the thirst intensity score and the TDS total score, the ρ for the thirst distress score and the TDS total score, and the ρ for the average VAS score and the TDS total score. In terms of construct validity, Spearman correlation was used again to assess the relationship between the two VAS questions: thirst intensity and thirst distress.

To test sensitivity, participants were separated into four groups based on quartiles of solid-fasting time and another four groups based on quartiles of fluid-fasting time. Comparisons of raw data were made across the four quartiles for both solid-fasting and fluid-fasting groups using the Kruskal-Wallis test, and two quartiles using the Mann-Whitney U. The Spearman's correlation was used to determine the relationship between fasting time and the TDS total score, the thirst intensity score, the thirst distress score and average VAS score. Additionally, a Mann-Whitney U test was used to test the differences in scores and the length of fasting time between patients with or without IV fluids. A p-value of <0.05 was considered as significant.

Results

Sample characteristics

The study included 161 participants, with the majority of patients coming from the surgical wards. The median (and IQR) time fasting for solids and clear fluid were 16 (12) and 10 (13) hours, respectively. A total of 88 (54.66%) participants were receiving IV fluids.

Criterion validity

Median (IQR) scores from the TDS and the VAS questions for all patients are displayed in Table 2. The scores generated from the TDS were used as the reference to assess the criterion validity of the VAS. A strong positive, significant correlation was found between the VAS measuring thirst intensity and the TDS (ρ=0.66, p<0.001), between the VAS measuring thirst distress and the TDS (ρ=0.71, p<0.001), and between the average VAS and the TDS (ρ=0.72, p<0.001).

Construct validity

In terms of construct validity, a very strong positive and significant correlation was registered between the two VAS questions (ρ=0.84, p<0.001). Patients with a greater thirst intensity score had a significantly higher thirst distress score.

Sensitivity

In order to investigate the sensitivity of the VAS questions and compare it with the TDS, patients were classified into four groups according to their reported hours of fasting from solid foods and another four groups according to their reported hours of fasting from fluids. The fasting from solids groups (and the number of hours fasting) were: Group 1 (<12 hours), Group 2 (12–15.5 hours), Group 3 (16–23 hours), Group 4 (> 23 hours). The fasting from liquids groups (and the number of hours fasting) were: Group A (< 2 hours), Group B (2–9.5 hours), Group C (10–14.5 hours), Group D (> 14.5 hours). Timeframes were determined to provide about equal numbers of participants in each of the groups. The median scores of the TDS, the thirst intensity VAS, the thirst distress VAS and the average VAS of patients in solid-fasting groups and fluid-fasting groups are displayed in Table 2 and Table 3, respectively.

The median TDS total score, the median VAS scores for thirst intensity and thirst distress and the average VAS score significantly correlated with the amount of time patients were fasting from solids (ρ=0.331, 0.421, 0.390 and 0.422, respectively, all p<0.001). The Kruskal-Wallis test indicated that the scores for all the solid-fasting groups were significantly different (all p<0.001). As shown in Table 2, patients with shorter solid-fasting times had overall lower scores in the TDS, the VAS for thirst intensity and the average VAS compared to groups with longer solid-fasting time. Patients in Group 4 fasting for more than 23 hours were found to score significantly higher in all scores than patients in Group 1 who fasted for less than 16 hours (p<0.001). Statistical significance was also observed in all scores between Group 2 and Group 4 (p<0.001).

For groups that were categorised based on the time fasting from fluids, the length of fast was significantly correlated with the thirst intensity score and the average VAS score (ρ=0.158 and 0.173, respectively, both p<0.05). However, there was no significant statistical difference between the four groups in all the scores (TDS ρ =0.058, intensity VAS ρ=0.144, distress VAS ρ=0.181; average VAS ρ =0.176), although a trend was observed for higher thirst distress with increasing fasting time (see Table 3). Apart from the thirst distress score, group A had higher median

Table 2: Median scores and statistical analysis of the differences in scores of the thirst discomfort scale (TDS) and the visual analogue scales (VASs) in solid-fasting groups

	Group 1 (n=39)	Group 2 (n=40)	Group 3 (n=37)	Group 4 (n=45)	Total (n=161)
TDS total score	3.00 (8.00)	4.00 (5.00)	6.00 (7.00)	9.00 (6.00)	6.00 (7.00)
Significant difference with	Group 4	Group 4			
Thirst intensity VAS score	4.00 (3.90)	4.60 (5.10)	6.00 (3.60)	6.40 (3.20)	5.00 (4.20)
Significant difference with	Group 3 Group 4	Group 3 Group 4			
Thirst distress VAS score	3.00 (5.00)	2.65 (4.60)	5.00 (3.80)	7.00 (4.70)	4.50 (5.30)
Significant difference with	Group 3 Group 4	Group 3 Group 4	Group 4		
Average VAS score	3.50 (4.00)	3.68 (4.69)	5.00 (2.88)	7.00 (4.00)	5.00 (4.88)
Significant difference with	Group 3 Group 4	Group 3 Group 4			

Table 3: Median scores and statistical analysis of the differences in scores of the thirst discomfort scale (TDS) and the visual analogue scales (VASs) in fluid-fasting groups

	Group A (n=35)	Group B (n=39)	Group C (n=45)	Group D (n=42)	Total (n=161)
TDS total score	7.00 (7.00)	5.00 (7.00)	4.00 (7.00)	8.00 (6.00)	6.00 (7.00)
Significant difference with			Group D		
Thirst intensity VAS score	5.00 (5.00)	4.90 (3.70)	5.90 (4.20)	6.20 (3.10)	5.00 (4.2)
Significant difference with		Group D			
Thirst distress VAS score	3.10 (5.30)	4.00 (5.50)	5.00 (4.60)	5.00 (4.40)	4.50 (5.3)
Significant difference with		Group D			
Average VAS score	4.10 (5.25)	3.50 (3.85)	5.00 (4.13)	5.43 (3.61)	4.88)
Significant difference with		Group D			

scores than group B (seeTable 3). On the other hand, although group A patients had lower median scores for the TDS, the thirst intensity VAS, the thirst distress VAS and average VAS (7.00, 5.00, 3.10 and 4.10, respectively) than those for patients in group D (8.00, 5.43, 6.20 and 5.00, respectively), no significant differences were found between these two groups for all the scores (p=0.541, 0.125, 0.150 and 0.135, respectively). Instead, a significant difference was observed between Group B and Group D for all VAS scores, and between Group C and Group D for the TDS total score.

IV fluid therapy

The 161 patients in the study were also classified into two groups according to whether or not they received IV fluid therapy. Median fasting time and median scores of all measurements broken down by IV fluid status are presented in Table 4. The Mann-Whiney U test indicated significant differences in time spent fasting and all scores between the two groups; however, this result was weaker for the TDS total score. Overall, patients receiving IV fluids had longer median fasting time and higher scores in the TDS and the VAS questions.

Discussion

To our knowledge, this is the first study validating a VAS for thirst intensity and thirst distress from a patient's perspective. This study demonstrates that the two VASs had acceptable criterion and construct validity in evaluating thirst intensity and thirst distress and were comparable to the TDS. Results show that the VAS questions were sensitive enough to detect thirst intensity and thirst distress dependent on the amount of time fasting from solid food. However, this finding didn't apply to the same cohort of patients

Table 4: Median values and statistical analysis of the differences in solid and fluid fasting times and scores of the thirst discomfort scale (TDS) and the visual analogue scales (VASs) according to IV fluid status

IV fluids status	With IV fluids (n=73)	Without IV fluids (n=88)	Total (n=161)	P*
Time spent on fasting from solid food	23.00 (44.75)	14.00 (9.00)	16.00 (12.00)	P < 0.001
Time spent on fasting from fluids	12.50 (16.00)	6.50 (11.00)	10.00 (13.00)	P < 0.01
TDS total score	7.00 (6.00)	5.00 (7.00)	6.00 (7.00)	P < 0.05
Thirst intensity VAS score	6.00 (3.90)	5.00 (4.90)	5.00 (4.2)	P < 0.01
Thirst distress VAS score	5.00 (5.50)	3.85 (5.00)	4.50 (5.3)	P < 0.01
Average VAS score	5.00 (4.32)	4.58 (4.50)	5.00 (4.88)	P < 0.01

*Differences between with and without IV fluids were assessed using the nonparametric Mann-Whitney U test

when assessed against the amount of time fasting from fluids.

Hence, the criterion validity of the two VAS questions was supported by their positive and significant correlations with the validated TDS. In terms of construct validity, as hypothesised, the thirst distress VAS showed strong significant correlation with the thirst intensity VAS. Like previous studies this demonstrates that as thirst intensity increases so does thirst distress[22,25,26]. The two VAS questions yielded acceptable levels of construct validity in this patient population.

In terms of sensitivity, the VAS questions have been shown to perform better than the TDS in groups categorised according to the length of time fasting from solids. Similar to data reported by Tosun et al.[27] scores for thirst intensity and thirst distress were associated with the amount of time spent fasting from solids. As such, patients' thirst intensity and thirst distress levels increased with increased length of fasting. Despite both tools showing acceptable sensitivity in solid-fasting, there was no demonstrable score differences between fluid-fasting groups. One possible explanation for this is a degree of ambiguity around the question 'When was the last time you had something to drink?'. Some patients were allowed to receive sips of water for comfort or water with medications during their fast and may regard this as 'something to drink'. This could result in underreporting of fluid-fasting times while still demonstrating thirst distress scores associated with a much longer fast. Study design to address this, and further patient education, may be useful in future studies in this area.

IV fluid therapy is often prescribed to prevent or relieve dehydration in fasting patients[28]. Patients undergoing IV fluid therapy demonstrated greater median scores in both TDS and VAS but were also subjected to longer fasting periods. This finding suggests that IV fluid therapy alone does not effectively reduce perceived thirst and its associated distress. Within our cohort this finding is potentially confounded by a selection bias such that patients receiving IV fluids were also undertaking longer fasts. Despite this, it should be considered that patients having shorter fasting times may also benefit from IV fluids to reduce both thirst and distress levels. Holte and Kehlet demonstrated the benefits of IV fluid therapy in relieving symptoms of dehydration, including light-headedness and fatigue, but found that oral fluid therapy is more effective in the relief of perceived thirst[29]. This suggests that it is important to address both physiological and psychological responses to fasting in order to improve patient comfort. Foremost should be implementation of fasting guidelines to allow clear fluids up to two hours prior to surgery, procedures and tests requiring anaesthesia. Where fasting cannot be prevented, thirst interventions such as regular mouth care, oral swabs, ice cubes and lip moisturiser should be considered together with IV hydration to help reduce thirst-associated discomfort and improve patient reported outcomes[16].

It has been demonstrated that there is a direct correlation between patient satisfaction and their perception of receiving high-quality care[30]. It has also been shown that, for patients, thirst and dehydration are the most distressing aspects of fasting[8]. Thus, it is necessary in the clinical setting to have the ability to objectively quantify levels of thirst intensity and thirst distress in fasting patients in order to improve their hospitalisation experience and quality of life. To date, the TDS has provided a relatively simple tool for thirst distress evaluation; however, this tool can be time consuming and confusing for some patients, limiting its use as a quick evaluation tool of thirst-related interventions. The VAS allows patients to visually represent their feelings more precisely on a linear scale, promoting objectivity[31]. Recent data describes the importance of identifying thirst distress to enable the implementation of best practice fasting guidelines[4]. The current study demonstrates the VASs to be both sensitive and specific in the objective measurement of thirst and its associated distress. This allows early recognition of fasting-associated distress and has the ability to help practitioners prescribe fasting protocols in line with patient-centred care and current guidelines. The ability of the VASs to provide rapid and accurate assessment of patient-reported thirst distress means clinical departments should consider implementing it into everyday practice to provide feedback on prolonged fasting and ensure timely thirst intervention, ultimately improving patient-reported outcomes.

Limitations

This study is limited by a lack of demographic and clinical data, which could contribute to sampling bias. As such it is difficult to comment on the application of these findings in specific cohorts. Further studies should seek to quantify the impact of confounding variables on patient's fasting experience such as accumulated thirst distress in patients undergoing repeated periods of fasting. Similarly, implementation of oral thirst interventions can also impact distress scores by significantly reducing thirst-related discomfort[16,29]. A controlled study to minimise the impact of these variables is likely to be beneficial in broadening the application of the VAS.

Conclusion

The current study shows that the VAS is a valid and simple measure of thirst intensity and thirst distress, and sensitive in detecting a score difference based on fasting time. The VAS allows accurate and rapid assessment of thirst-related distress in fasting patients, which can be used to provide timely instigation of thirst interventions. Through the provision of objective data with regards to thirst distress, it is hoped that the VAS can be used in future research to provide insight into patient experience. Implementation of strategies to reduce fasting times to fit within current guidelines, should include patient-reported outcomes such as the VAS to improve patient care.

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To stand or not to stand? Implications of prolonged standing for perioperative nurses: A discussion paper

Abstract

Perioperative nurses, including perianaesthesia, instrument and circulating nurses, stand for most of their shift – anywhere from one to eight hours at a time. This prolonged standing has been linked to negative effects on health, increasing the incidence of musculoskeletal disorders, such as lower back pain and neck pain, and cardiovascular diseases, such as oedema, varicose veins and venous pooling.

Given the impact these workplace injuries have on nurses, and on workplaces through financial costs associated with sick leave and/or workers compensation claims, surely prevention would be better than cure. While limited research exists to categorically suggest what prevention strategies are best, several options are available for consideration.

The use of anti-fatigue mats has been associated with lower incidence of back pain. It is suggested that perioperative nurses consider using sit–stand stools, if available, and compression socks at 15–20 mmHg, if standing in a static position for long periods.

Proper posture while standing – described as a neutral pelvis, natural thoracic curvature, flat abdomen, aligned shoulder, hip and ankles and an erect head – can assist in preventing disorders associated with prolonged standing. A combination of stretching and strength training for perioperative staff can help improve musculoskeletal symptoms experienced due to poor posture and tension, and the introduction of microbreaks has also seen improvements in concentration and comfort while reducing fatigue and discomfort.

This paper will discuss the health effects of prolonged standing and provide information about ergonomic interventions, compression socks or stockings, stretching programs and microbreaks for perioperative nursing teams to consider.

Key words: prolonged standing, anti-fatigue mat, perioperative nurse, health implications, musculoskeletal disorders, cardiovascular impairment, stretching program, microbreaks

Introduction

This paper will argue that current ergonomic aids and prevention strategies are essential to reduce the negative effects of prolonged standing experienced by perioperative nurses. Perioperative nurses, who are valued members of the perioperative team, expose their bodies to the risk of developing musculoskeletal disorders and soft tissue injuries due to their work environment[1]. However, instrument and circulating nurses are at particular risk as they are required to stand for long periods of time and perform movements including lifting, pushing, pulling, twisting and retracting[2]. When carrying out

their role, instrument nurses will maintain either a static posture or perform repetitive movements that are sustained for the duration of the surgery[2]. To help prevent adverse effects on health, multiple ergonomic interventions have been studied to determine if they reduce these risks. Together with the health implications of prolonged standing, this paper will discuss ergonomic interventions, including anti-fatigue floor mats, sit–stand stools and postural training, as well as compression socks or stockings, stretching programs and microbreaks.

Health implications

During surgery, prolonged standing is a common occurrence that not only becomes uncomfortable over time but is also detrimental to health[1]. The combination of standing while twisting, lifting, retracting, pushing and pulling are classified as high-risk tasks for developing soft tissue and musculoskeletal injuries in the perioperative workplace[2]. Lower back pain was documented as being the most prevalent complaint of perioperative nurses, with over 60 per cent of perioperative nurses in a 2021 study suffering from this issue[1].

The incidence of musculoskeletal injuries and discomfort – in particular, lower back pain – is a common health problem that is directly associated with prolonged standing, static positioning and repetitive movements[2,3]. The incidence of lower back pain in nurses is linked to increased sick leave and reduced productivity[4]. In a 2018 study that surveyed the prevalence of lower back pain in instrument and circulating nurses (n=250), most respondents (84%) reported at least one episode of lower back pain during the past year that was attributed to repetitive, static movements ($p<0.05$) or assisting with patient positioning ($p<0.01$)[4].

Cardiovascular disease, chronic venous disorders and chronic vascular insufficiency are also health issues commonly associated with professions that require prolonged sitting and standing[5]. A 2020 study that documented symptoms of chronic venous insufficiency suffered by participants (n=500) in careers requiring sitting or standing for more than four hours per day found that the most common complaint of health care workers (n=111) was heaviness, swelling and numbness to the lower extremities[5]. Another study conducted in 2020 investigated the link between female nurses (n=181) and prevalence of varicose veins[6]. A direct correlation was established between the standing time of nurses and the risk of developing varicose veins ($p=0.01$)[6]. Furthermore, it was noted that for every hour of static standing the risk of developing varicose veins increased ($p=0.00$), with 53.9 per cent of perioperative nurses in the study formally diagnosed with this condition[6]. A Canadian study conducted over 12 years found that gender plays a role in incidence of chronic venous disorders, with women ($p<0.001$) at a higher risk than men of developing cardiovascular disease due to prolonged standing ($p=0.03$)[7].

Ergonomic interventions

Throughout prolonged surgery the instrument and circulating nurses frequently stand unaided for the duration of the case and operating theatre floors, due to infection control requirements, are commonly rigid in nature[8]. Ergonomic interventions to reduce harmful effects of this rigidity include anti-fatigue mats, sit–stand stools and postural training.

Anti-fatigue mats are designed to provide a flexible surface that aims to disrupt stability and encourage muscle activation thus improving venous flow[8]. Aghazadeh et al. conducted a study that showed no significance in muscle activation when anti-fatigue mats were used, although there was a noted reduction in lower back pain ($p<0.05$)[3]. Currently there are limited studies to conclude whether or not anti-fatigue mats are effective in improving musculoskeletal discomfort and injury[9]. There is also a lack of literature to suggest if age, gender and oral intake have a significant effect when using anti-fatigue mats[9]. It is important to note that although anti-fatigue mats may provide pressure relief and increased comfort, they are also a hazard for tripping so caution should be taken when they are used during surgery[9].

Sit–stand stools can improve comfort for the instrument or circulating nurse during surgery[2]. Using a sit–stand stool can reduce the weight load in nurses' legs, feet and back providing better body weight distribution, improving venous flow and reducing spinal loading[2,6]. A 2019 study (n=24) documented a hybrid position between sitting and standing as a favourable position for both genders ($p<0.005$) in creating natural pelvic and lumbar angles and reducing body weight tension and loading[10]. While it is not always acceptable for the instrument or circulating nurse to use this equipment, a sit–stand stool should be used when appropriate[10].

Prolonged standing with or without ergonomic aid can, over time, cause postural strain[11] and poor posture is one of the leading causes of musculoskeletal pain in the operating theatre[11]. Proper posture while standing is when the pelvis is in a neutral position, the thoracic spine has its natural curves, the abdomen is flat, the shoulder, hip and ankles are aligned, and the head is erect[11]. A combination of stretching and

strength training for perioperative staff can improve posture and aid in reducing musculoskeletal symptoms experienced due to poor posture[11].

Compression socks or stockings

Compression socks are commonly used to assist in alleviating vascular-related issues through increasing venous pressure, reducing oedema and improving blood flow[12]. There is a variety of compression socks and stockings available ranging from ankle and thigh to full stocking length, with multiple grades of compression[13]. A recent randomised trial conducted by Lee et al. showed that female nurses (n=20) reported higher levels of satisfaction wearing thigh length compared to knee length compression socks (p=0.041)[13].

Belczak et al. studied the effects of 15–20 mmHG, and 20–30 mmHg compression on individuals who work in roles requiring prolonged standing, sitting and a combination of the two[13]. The results showed that compression of 20–30 mmHg provided the biggest reduction in volumetric measurements for the sitting cohort (p<0.001)[14]. For instrument and circulating nurses, compression of 15–20mmHg was recommended as this is more effective for improving venous flow and comfort when standing during surgery[14,15]. While compression socks and stockings have been found to be effective in relieving pain (p=0.002) and aching (p<0.0001) their tightness can make them difficult to don and cause discomfort with prolonged wear[12,15].

Stretching programs and microbreaks

A study conducted in America found that although stretching can improve posture and relieve symptoms, there is a lack of education about and practice recommendations for postural awareness in the perioperative environment[11].

An Australian study (n=42) investigated the use of a stretching program involving multidisciplinary perioperative staff[16]. The program was based on previously successful stretching programs in other workplaces and was set up in a vacant recovery room bay, with orientation to the program being provided by a physiotherapist[16]. The study reported that before the stretching program was implemented a muskuloskeletal-related incident was four times more likely to happen in the perioperative department than in the rest of the hospital; after the stretching program was implemented this likelihood was reduced by 60 per cent (OR 0.4, 95% CI 0.1, 8.0 p = 0.01)[16]. More than 70 per cent of participants stated that the program was feasible and 85 per cent felt it was a good fit for the operating suite. However, a common problem reported by staff was that there was not enough time to access the program[16].

A group of surgeons combined stretching and microbreaks using evidence from other industries[17]. Findings revealed that microbreaks with exercise either provided no change or improvement in mental focus (88%) and physical performance (100%) of participants, with minimal disruption to the flow of surgical lists[17]. Taking microbreaks was documented as beneficial to the surgical team, allowing time to stretch and reduce fatigue and discomfort while not disrupting the flow of surgery or increasing surgical time[17]. Recommendations to include stretching and microbreaks into the operating room were praised by 87 per cent of surgeons (n=56)[17].

Practice recommendations

It is recommended that perioperative nurses, and the whole perioperative team, look closely at the range of strategies available to prevent the harmful effects of prolonged standing. Safe Work Australia identifies hazardous manual tasks that can lead to musculoskeletal disorders[18]. Many of the daily tasks carried out by perioperative nurses during surgery fall into the category of hazardous manual tasks as described by Safe Work Australia; however, currently there is no legislation in place requiring ergonomic aids to be used in health facilities. The Association of periOperative Registered Nurses (AORN) has published a set of guidelines that recommend nurses should not stand for more than 30 per cent of their shift, and proposes that pregnant nurses should spend no more than three hours in static positions, due to the risk of foetal harm[2]. The introduction of Australian safety legislation would assist in compliance with using ergonomic interventions and measures to prevent cardiovascular disease associated with prolonged standing.

It is noted that while wearing compression socks or stockings is a simple intervention, using sit–stand stools is not always an option, as the instrument nurse is often required to stand while completing static and repetitive movements for lengthy surgeries[2], and anti-fatigue mats may be tripping hazards.

Education about the importance of good posture and the introduction of exercise programs and microbreaks may also aid in the prevention of cardiovascular and musculoskeletal disorders.

Conclusion

This discussion paper has argued that ergonomic interventions and prevention strategies are essential to reduce the harmful effects experienced by all perioperative nurses due to prolonged standing.

Currently, there is not enough research available to draw a definitive conclusion about the most appropriate method for reducing the effects on health that are associated with prolonged standing for the perioperative nurse. All ergonomic methods and strategies possess benefits that perioperative nurses can gain from when used correctly. A recommendation from this paper would be for more research to be conducted into this vitally important occupational health and safety concern.

Health facilities may ultimately be responsible for making ergonomic equipment available to employees and for introducing preventative stretching exercise programs and microbreaks. Given the impact of workplace injuries, on both nurses and their employers, prevention may be better and more cost effective than cure. It is time to look at prevention strategies in your workplace.

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The incidence of peripheral nerve injuries related to patient positioning during robotic-assisted surgery: An evidence summary

Abstract

Objective: To describe the incidence and anatomical locations of peripheral nerve injuries (PNIs) related to patient positioning during urologic, gynaecologic and colorectal robotic-assisted surgery (RAS).

Background: Incorrect positioning of extremities and lack of assistive devices in steep Trendelenburg (up to 45°) positioning during urologic, gynaecologic and colorectal RAS places the patient at potential risk of nerve injury.

Method: A structured search of recent systematic reviews published between January 2019 and August 2021 in the Cochrane Library, PubMed, ProQuest and Google Scholar databases using search terms 'patient positioning', 'robotic-assisted surgery', 'Trendelenburg', 'complication' and 'injury' with medical subject headings (MeSH) was conducted.

Results: The overall incidence rates of PNI associated with patient positioning during RAS varied from 0.16 to 10.8 per cent. The most common anatomical positions of nerve injuries in upper extremities related to patient positioning during RAS were identified in brachial plexus, ulnar, median, radial and humeral nerves. For lower extremities, nerve injuries were identified in the sciatic, femoral, obturator, femoral cutaneous and common cutaneous nerves.

Conclusion: Operating room teams should develop institutional policies to support perioperative practice that is based on the best available evidence.

Application: This evidence summary supports the need for frequent routine checks and constant monitoring of the patient's position through the operating procedure.

Key words: steep Trendelenburg, assistive devices, intraoperative complications, patient positioning, patient monitoring

Background

To provide optimal intraoperative exposure and visualisation, patient positioning during urologic, gynaecologic and colorectal robotic-assisted surgery (RAS) often requires the lithotomy positioning with steep Trendelenburg (up to 45°)[1–6]. Incorrect patient positioning or even extended operative time in this position places the patient at potential risk of several complications[4]. As expected, due to steeper angles of Trendelenburg positioning, patients have a greater tendency of cephalad migration (sliding down toward the direction of the head)[5]. The most observed complications are peripheral nerve injuries (PNIs) discovered in the upper and lower extremities[2,7]. Researchers, however, also report central nervous system complications,

haemodynamic and respiratory disturbances, ocular injuries and complications in the urinary and gastrointestinal systems[2,8,9].

Suboptimal positioning of extremities and lack of assistive devices increases the risk of nerve injury from stretch and compression, generalised ischaemia and metabolic disorders[1,2,7]. PNIs may have profound impacts on patients, as they can culminate in loss of limb function and thus compromise quality of life[7,10]. To ensure that patients are not exposed to injury, knowledge of injury mechanisms, anatomy and physiology and appropriate patient positioning as well as intraoperative attention to vital signs and assessment of specific risk factors (e.g. obesity, pre-existing neurological conditions, >240 minutes operative time) are essential[1,2,11–14].

Research question

Systematic reviews following rigorous methodological approaches, can take a substantial amount of time to complete, and they may not meet the specific needs of the end-user[15]. Evidence summaries are short, easily read documents that provide a succinct presentation of the available evidence in a particular clinical area. While they are not as comprehensive as literature reviews, evidence summaries are less time consuming to undertake. Further, evidence summaries have emerged to synthesise the evidence on defined questions and assist policymakers and practitioners in using the best available evidence to decide on clinical interventions[15–17].

The purpose of this evidence summary is to identify clinical considerations in relation to patient positioning during urologic, gynaecologic and colorectal RAS procedures. Thus, we aimed to describe the related incidence and anatomical locations of PNI as well

Table 1: The characteristics and key findings of the systematic reviews

Author (year)	Types of included studies, time period	Review question	Findings	Limitations	Implications for practice and research
Bjøro et al. (2020)[11]	11 quantitative studies, including 6 registry-based, 3 longitudinal prospective, 1 RCT and 1 combined register-based with survey design. Articles published Jan 2000 to Feb 2019.	To determine: • the incidence of IPNI • risk factors for IPNI • pain and symptoms of IPNI in patients undergoing RAS laparoscopic urologic, gynaecologic and colorectal procedures in lithotomy positioning with steep Trendelenburg • the impact of IPNI on patients' function and quality of life	The overall incidence of IPNI ranges from 0.16% to 10.0%. The incidence of upper extremity injury ranges from 0.1% to 3.6%, and lower extremity injury ranges from 0.2% to 10%. Risk factors for IPNI related to positioning were prolonged operative time, patients' comorbidities and high ASA and BMI scores.	Most data were retrieved from registry-based studies, as retrospective reviews. Recording of IPNI was dependent on the reporting of symptoms, prospective standardised tools for reporting complications were not used in the studies. Studies were not designed to systematically record IPNI due to positioning or evaluate IPNI at the time of incidence.	Knowledge of mechanisms for injury, positioning, anatomy/physiology and evaluation of risk factors to ensure that patients are not exposed to IPNI is crucial. Further research should focus on: • reduction of IPNI associated with positioning in RAS • how IPNI affects patients' function and quality of life • the physiological consequences of IPNI related to the patients' positioning in RAS.
Cornelius at al. (2021)[6]	6 studies, including 1 prospective RCT and 5 retrospective cohort studies. Articles published Jan 1990 to Mar 2020.	To review: • the frequency of IPNI • the impact of positioning-related post-operative PNI in patients undergoing RARP	The incidence of PN associated with RARP varies from 1.3% to 10.8% for lower extremities and from 1.1% to 1.9% for upper extremities. Increased intraoperative time, ASA score, patients' comorbidities and positioning correlate with the incidence of post-operative PN.	Techniques for detecting and reporting PN and a detailed description of patient positioning were not standardised. Due to the low number of eligible studies and heterogeneity of study designs, it was impossible to draw recommendations regarding favourable patient positioning.	Further research should focus on: • prevention of PN after RARP • the impact of BMI • comparison between standardised Trendelenburg versus steep Trendelenburg position.
Das et al. (2019)[3]	7 studies, including 3 RCT and 4 case studies. Articles published Jan 2003 to Mar 2018.	To evaluate: • techniques, devices and equipment for patient positioning • the cephalad patient slide and neuropathy on patient outcomes in laparoscopic and RA gynaecologic surgery	The mean cephalad patient slide ranged from 1.07 ± 1.93 cm to 4.5 ± 4.0 cm. The overall incidence of neuropathy was 0.16%. The duration of surgery and BMI did not correlate with an increase in position-related injuries.	Due to the heterogeneity of the studies, a meta-analysis across studies could not be undertaken, limiting any definitive conclusions regarding the best technique and devices to prevent cephalad slide and neuropathy in RA laparoscopic gynaecologic procedures.	Further research should focus on: • head-to-head comparisons of anti-slide devices and techniques that also evaluate patient displacement • degree of Trendelenburg position and transient or permanent neuropathy • other relevant information – time to position the patient, cost of devices, impact of BMI, operative time.

Abbreviations: RCT – randomised control trial, IPNI – intraoperative peripheral nerve injury, PN – peripheral neuropathy, RA – robot-assisted, RAS – robot-assisted surgery, RARP – robot-assisted laparoscopic radical prostatectomy, ASA – American Society of Anaesthesiologists physical status classification system, BMI – body mass index.

as patient risk factors. Our research was underpinned by the research question: 'What is the incidence of PNI related to steep Trendelenburg patient positioning during RAS?'. This question was framed based on the PIO (Population, Issue, Outcome) framework:

P – patients undergoing RAS

I – steep (up to 45°) Trendelenburg patient positioning

O – PNI.

Search strategy

This evidence summary is based on a structured search of recent systematic reviews[3,6,11] published between January 2019 and August 2021 in the Cochrane Library, PubMed, ProQuest and Google Scholar databases. Search terms 'patient positioning', 'robotic-assisted surgery', 'Trendelenburg', 'complication' and 'injury' with medical subject headings (MeSH) were used to execute searches.

A summary of selected studies

The characteristics and key findings of the systematic reviews are summarised in Table 1.

Quality of selected studies

We did not undertake a formal quality appraisal of the included systematic reviews. Rather, our intention was to present a concise summary of the evidence in this area, that is user-friendly for busy clinicians. For a more detailed evidence synthesis such as a review of reviews (i.e. 'umbrella review'), the AMSTAR 2 (A MeaSurement Tool to Assess systematic Reviews 2)[18] has been designed to evaluate different aspects of reviews.

Table 2: The incidence of PNI associated with patient positioning during RAS

Author (year)	Number of studies in the review	Number of patients	The incidence of PNI		
			Overall	Upper extremities	Lower extremities
Bjøro et al. (2020)[11]	11	179.802	0.16% – 10.0%	0.1% – 3.6%	0.2% – 10.0%
Cornelius et al. (2021)[6]	6	63.667	1.1% – 10.8%	1.1% – 1.9%	1.3% – 10.8%
Das et al. (2019)[3]	7	2.024	0.16%	NR	NR

Abbreviations: PNI – peripheral nerve injury, NR – not reported.

A summary of the evidence

The incidence of PNI associated with patient positioning during RAS was reported in all reviewed studies[3,6,11] (Table 2). Overall incidence rates varied from 0.16 to 10.8 per cent. The cephalad patient migration was reported in one study[3]; the mean migration/slide distance using various devices ranged from 1.07 ± 1.93 cm to 4.5 ± 4.0 cm.

The most common anatomical positions of injuries in extremities related to patient positioning during RAS, as identified in systematic reviews by Bjøro et al.[11] and Cornelius et al.[6], are displayed in Table 3.

PNIs associated with patient positioning during RAS were related to patient risk factors such as high BMI (body mass index) and ASA (American Society of Anaesthesiologists physical status classification system), prolonged procedure time and multiple comorbidities (Table 4).

Implications and recommendations

Due to the heterogeneity of study designs, techniques and combinations of devices used, it is impossible to determine the best approach and assistive devices to prevent PNI. However, to minimise the incidence of PNI during RAS with steep Trendelenburg patient positioning, this evidence summary supports the need for increased attention to frequent checks and monitoring of patients during the RAS procedure. All the actions taken

Table 3: Common anatomical positions of injuries in extremities related to patient positioning during RAS

Upper extremities	Lower extremities
• brachial plexus[6,11]	• sciatic nerve[6,11]
• ulnar nerve[11]	• femoral nerve[11]
• median nerve[11]	• obturator nerve[11]
• radial nerve[11]	• femoral cutaneous nerves[6,11]
• humeral nerve[11]	• common peroneal nerve[6]

Table 4. Relation of patient risk factors and positioning during RAS

Author (year)	Patient risk factors			
	Higher BMI	Higher ASA score	Increased intraoperative time	Patient comorbidities
Bjøro et al. (2020)[11]	related	related	related	related
Cornelius et al. (2021)[6]	NR	related	related	related
Das et al. (2019)[3]	not related	NR	not related	NR

Abbreviations: BMI – body mass index, ASA – American Society of Anaesthesiology physical status classification system, NR – not reported.

What can operating room (OR) teams do to minimise the incidence of PNI related to patient positioning during RAS?

- Develop institutional policies based on the best available evidence to guide practice.
- Cautiously select suitable patients and evaluate their risk factors[4].
- Formulate a dedicated robotic OR team introduced by skilled preceptors[4].
- Increase knowledge of anatomy/physiology and extend understanding of the mechanisms of injuries[11].
- Where appropriate, use a modest angle for Trendelenburg positioning[5].
- Constantly observe the patient's position throughout the operating procedure and implement regular routine checks.

should be precisely documented using the surgical safety checklist for RAS[19]. Moreover, patients need to be fully informed about the potential risk of RAS-related complications.

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