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Nursing care on a patient undergoing RAL - benefits and areas that need improvement: A thematic analysis

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ABSTRACT

Background: Robot-assisted laparoscopy (RAL) is an important surgical method that is expanding quickly. Despite its swift development, the research situation varies and from several perspectives there is a general lack of scientific evidence for RAL as a method.

Aim: The aim of the study was to investigate the perioperative nursing care of the patient undergoing RAL, with focus on the intraoperative climate and nursing measures.

Method: Data was collected through semi-structured interviews with perioperative registered nurses (RN). The interviews were analyzed using thematic analysis (TA) to identify and present patterns and themes.

Results: The patients intraoperative care is affected by RAL in several ways. For the perioperative RN, there is a lot to keep track of and think about in order to maintain asepsis and to ensure the patient's physical safety during these procedures. The positioning of the patient is important in order to avoid pressure ulcers and press-related pain injuries, as well as over-stretching and nerve damage. It is a larger sterile area in a narrow environment where it can be difficult to get an overview and maintain the asepsis.

Discussion: The study's results have contributed to new meaningful knowledge to the perioperative care in RAL. The difficulties with preparations and positioning were risk factors for the patient, in contrast with the advantages of the surgery for the same, which could however be improved and developed with the help of guidelines and follow-up.

Key words: patient positioning, patient safety, perioperative care, robotic-assisted surgical procedure

SAMMANFATTNING

Bakgrund: Robotassisterad laparoskopi (RAL) är en viktig kirurgisk metod som växer och utvecklas snabbt. Trots den snabba utvecklingen varierar forskningsläget och från flera perspektiv finns det en allmän brist på vetenskapliga bevis för RAL som en metod.

Syfte: Syftet med denna studie var att undersöka den perioperativa omvårdnaden av patienten vid RAL, med fokus på den intraoperativa miljön och omvårdnadsåtgärderna.

Metod: Data samlades in genom semistrukturerade intervjuer med operationssjuksköterskor. Intervjuerna analyserades med hjälp av tematisk analys (TA) för att identifiera och presentera mönster och teman.

Resultat: Patientens intraoperativa vård påverkas av RAL på flera sätt. För operationssjuksköterskor finns det mycket att hålla reda på och tänka på för att upprätthålla aseptiken och för att säkerställa patientens fysiska säkerhet under dessa ingrepp. Placeringen av patienten är viktig för att undvika trycksår och tryckrelaterade skador, liksom översträckning och nervskador. Det är ett större sterilt område i en trång miljö där det kan vara svårt att få en överblick och upprätthålla aseptiken.

Diskussion: Studiens resultat har bidragit till ny meningsfull kunskap om den perioperativa vården inom RAL. Svårigheterna med hjälpmedel och positionering var riskfaktorer för patienten, i motsats till fördelarna med operationen för detsamma, vilket dock kunde förbättras och utvecklas med hjälp av riktlinjer och uppföljning.

Nyckelord: patientpositionering, patientsäkerhet, perioperativ vård, robotassisterad kirurgi

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BACKGROUND

Robots in healthcare

In the 1980s, laparoscopy was introduced as a surgical method and has since become an increasingly common alternative in different surgical conditions (Baek, Lee, Park & Kim, 2011). In 2000, the technology was approved to be used for performing robot-assisted laparoscopic surgery (RAL). Robot-assisted methods has previously only been used in some open surgery and in endoscopic procedures (George, Brand, LaPorta, Marescaux & Satava, 2018). RAL is a technology under continuous development that is increasingly being used (Maerz, Beck, Sim & Gainsburg, 2017; Mathew, Markey, Murphy & Brien, 2018; Talab, Elmi, Sarma, Barrisford & Tabatabaei, 2016;), considered by some to be irreplaceable for certain procedures (Takmaz, Asoglu & Gungor, 2018).

Society's profits

Balancing healthcare services' growing costs while offering the highest quality care is challenging (Allers et al., 2016). RAL as a surgical method can mean some gains. The method itself costs more than other types of surgery (Allers et al., 2016; Catchpole et al., 2016) and the operative times are still longer than for conventional surgery as laparoscopy and laparotomy (Anger et al., 2014; Johansson & von Vogelsang, 2019; Liu et al., 2014; Trastulli et al., 2015) although, in many cases the method is considered effective and safe (Catchpole et al., 2016; Mathew et al., 2018; Tse, Ngan & Lim, 2017).

The hospital stay for the patients has been shown to shorten by up to one or a few days (Ahmed et al., 2012; Leow et al., 2014; Liu et al., 2014; Medical Advisory Secretariat, 2010; Mir, Cadeddu, Sleeper & Lotan, 2011; Trastulli et al., 2015). It could be that the postoperative complications are reduced for the patients as the method involves a refinement of the operators' movements, generating in higher precision and better ergonomic working conditions. As a result, it can be seen that internal bleedings are less frequent compared to conventional surgery (Ahmed et al., 2012; Medical Advisory Secretariat, 2010; Trastulli et al., 2015; Wallerstedt et al., 2015).

Technology and ethics

The ethical debate considered RAL is primarily based on questioning of how much technology should be automated when it comes to healthcare for people (Siqueira-Batista,

Souza, Maia & Siqueira, 2016). The understanding of technology focuses on machinery and equipment (Barnard & Gerber, 1999) and as a perioperative registered nurse (RN), their technical focus is stated in the way of their interpersonal competence (Bull & FitzGerald, 2006). However, there are additional dimensions, in addition to technical skills and knowledge, to take into account when it comes to technology in healthcare as the environment, clinical opportunities for nursing and professional status (Barnard & Gerber, 1999; Bull & FitzGerald, 2006).

Barnard and Gerber (1999) argue that technology as a concept includes parts significant for nursing theory, practice, leadership, education and research. It is supported by Bull and FitzGerald (2006), who believe that the technical focus of perioperative RN's is more about ensuring patient safety through nursing ethics linked to patient-centered care. It can be seen as a phenomenon with the opportunity to improve and to be crucial to the quality of nursing, patient experiences and the development of care science (Barnard & Gerber, 1999).

When it comes to RAL, it is not about the robot having taken over a task from the human being, it still requires the same amount of staff on the floor and should rather be seen as an extension of the staff (Siqueira-Batista et al., 2016). But there are insufficient theoretical interpretations of experiences necessary to be able to create a framework for ethical aspects regarding technology in healthcare (Barnard & Gerber, 1999).

The robot and the patient

The most common position of the patient at RAL is dorsal lithotomy-Trendelenburg, a position where the patient's legs are clamped in leg supports that are raised and held apart, and where the head end is lowered to achieve a slope of up to 30 degrees (Rothrock & McEwan, 2012, p. 175). The position is stressful for the patient and, in combination with long operative times, can lead to an increased risk of the occurrence of postoperative pain conditions (Bauer et al., 2014; Demasi, Porpiglia, Tempia & D'Amelio, 2018; Gezginci et al., 2015; Johansson & von Vogelsang, 2019; Yamada et al., 2016). The fact that the patient is afflicted with rhabdomyolysis or compartment syndrome occurs, but is more unusual, while postoperative pain related to overstretched joints and neuropathic damage is all the more frequent (Ginsburg, Pape, Heilbronn, Levin & Cher, 2018). Position-related problems are underreported and involve a great deal of hidden statistics (Talab et al., 2016).

To safely position the patient on the operating table is a challenge and often a concern for the team (Talab et al., 2016). It is time-consuming that prolongs long-term operative times (Maerz et al., 2017). Good planning is required to be able to meet the criteria to minimize the risks of position-related injuries and to create the visual field required for the robot to work without interruption (Gezginci et al., 2015; Hortman & Chung, 2015; Maerz et al., 2017; Takmaz et al., 2018). The positioning needs to be compression-free against the extremities and counteract shearing related to the steep slope. This means that the patient's arms and legs are padded and wrapped to minimize pressure points (Talab et al., 2016; Takmaz et al., 2018), but it reduces access for anesthesia staff and in itself poses a risk for compartment syndrome (Talab et al., 2016). If the patient previously has undergone surgery or have joint implants, the risk of pressure damage may increase further (Gezginci et al., 2015; Maerz et al., 2017).

Aids are often necessary to position the patient safely (Maerz et al., 2017), but these do not meet the criteria of counteract shearing and nerve damage (Talab et al., 2016). Innovations for assistive technology have not kept up in relation to the rate of surgical method development (Takmaz et al., 2018; Talab et al., 2016). Despite the positionings crucial role for patient safety, there is no standardized way of doing this (Talab et al., 2016). This may be the reason why we still see position-related problems (Takmaz et al., 2018).

Teamwork in presence of a robot

The entire team is responsible for promoting patient safety and preventing injuries regarding the patient's positioning on the operating table (Hortman & Chung, 2015). Teamwork has a central role in RAL (Allers et al., 2016) that combined with that the environment at RAL differs from conventional surgery since the operation team is no longer directly gathered around the patient, but rather more widely distributed in the operating room (OR). The main operator is enclosed in a console which affects the communication possibilities and in turn the teamwork (Alfredsdottir & Bjornsdottir, 2008; Allers et al., 2016). Working with a previously experienced team in this type of surgery reduces complications (Allers et al., 2016; Kang, Massey & Gillespie, 2015; Tse et al., 2017) and promotes work ethic and trust within the team (Alfredsdottir & Bjornsdottir, 2008).

The perioperative registered nurse's role

In the competence description for specialist nurses in surgical health care (Riksförening för operationssjukvård [RFOP], 2011), it is stated that the perioperative RN is responsible for ensuring that the patient is securely positioned, that the patient's integrity, autonomy and dignity are preserved, and that the perioperative RN should work in such a way that the emergence of care-related complications and damage is prevented.

When technology advances, it places higher demands on knowledge and technical skills of the perioperative RN's, it is important to keep professional skills current (Alfredsdottir & Bjornsdottir, 2008; Chitlik 2011; Kang, Gagne & Kang, 2016). With RAL, the role of the perioperative RN has been expanded and he or she has a crucial role for the patient safety culture (Kang et al., 2016). Preserving patient safety is their primary task by preventing mistakes and protecting the patient (Alfredsdottir & Bjornsdottir, 2008). But it is primarily non-technical skills that have been seen as the vital difference for patient safety (Alfredsdottir & Bjornsdottir, 2008; Catchpole et al., 2016; Kang et al., 2015). It is the perioperative RN who ensures that the operation flows in collaboration with the other team members and who is able to influence the operative length and how long the patient is in the inclined position (Chitlik, 2011).

A model for perioperative nursing care

The competence description (RFOP & Swenurse, 2011) is based on Tolleruds et al. (1985) model for perioperative nursing. In accordance with the basic pillars of most nursing theories, the perioperative RN has the consensus concepts of human, health, environment and nursing activities to take into account in the unique and specialized context in which they work. The model states that the person who goes through perioperative care should be regarded as a biopsychosocial being which is formed, and which also reacts based on the internal and external phenomena that have occurred and which take place in his life. Understanding the human as a perioperative RN should therefore be based on principles from biological, physiological, behavioral and social sciences (RFOP & Swenurse, 2011).

Nursing is a social phenomenon indispensable for people in need of care according to Tollerud et al. (1985). The fact that an individual within the health care system would have a biopsychosocial character is well established in the past through the World Health Organizations ([WHO], www.who.com) definition that only through "complete physical, mental and social well-being" can be experienced by the person. Health is therefore about the

experience of a phenomenon and it is the responsibility of the perioperative RN to safeguard the individual's experience throughout the perioperative care. The environment around the patient in perioperative care is also dominated by change. The person undergoes a change arising from the phenomenon where basic life-sustaining medical and / or surgical measures have become the most important (Tollerud et al., 1985).

Perioperative nursing is thus to help people in change, arising from a phenomenon in which basic life support measures are prioritized. Perioperative nursing is included in the three phases, pre-, intra- and postoperative nursing procedures, and is complex in its process. In the intraoperative phase, nursing acts mainly consist of measures for physical patient safety, asepsis and the environment, as well as the division of labor and teamwork in the OR. These are based on multidimensional use of knowledge, skill and interprofessional constellations of the perioperative RN (Tollerud et al., 1985).

Rationale

In RAL, it is important to pay attention to risk factors and efficacy for the patient in care (Mathew et al., 2018). For the perioperative RN the high-tech development means that demands are placed on knowledge and continuing education in order to adequately maintain safety and to maintain the patient's integrity (Alfredsdottir & Bjornsdottir, 2008; Kang et al., 2016).

Despite the accelerating development of robot surgery, the research situation varies and from several perspectives there is a general lack of scientific evidence for RAL as a method (Close et al., 2013; Liu et al., 2014; Tandogdu, Vale, Fraser & Ramsay, 2015). There is currently insufficient information for nursing and patients who develop intra- and postoperative complications, such as pressure ulcers or nerve damage, due to inadequate or strenuous intraoperative nursing measures. These patients run up to four times the risk of prolonged hospital stay. This can result in increased healthcare costs (Wen, Deibert, Siringo & Spencer, 2014) and, above all, unnecessary patient suffering. This study could provide new knowledge regarding perioperative nursing care for patients undergoing RAL.

Aim

The aim of the study was to investigate the perioperative nursing care of the patient undergoing RAL, with focus on the intraoperative climate and nursing measures.

METHOD

Design

The study was a descriptive exploratory interview study with inductive approach. The study presented comprehensive summaries of an event with rich details (Braun & Clarke, 2006; Polit & Beck, 2012, s. 505).

Sample

A convenience selection was made where the authors turned to a surgery ward that used RAL. This is an appropriated method when participants need to be recruited from a particular clinical setting (Polit & Beck, 2012, p. 516). To be included in the study the participants needed to be registered nurses (RN) with a specialist degree in surgical healthcare and to have participated in at least one surgery where RAL was performed. No internal loss occurred since all participants who agreed to participate in the study chose to pursue their participation. In total, six interviews were conducted where the participants were between 23 and 48 years old and where the experience of RAL varied from around a dozen surgeries to up to four years of experience. All study participants were women.

Table 1. Demographic data

Age(n)	Years as perioperative RN(n)	Numbers of RALs(n)	Years at RAL(n)
21-30(3)	1-3(3)	1-10(-)	1-3(3)
31-40(1)	4-6(2)	11-20(1)	4-6(1)
41-50(2)	7-9(-)	21-30(1)	7-9(-)
51-60(-)	10-12(1)	31-40(-)	10-12(-)

The number of participants was determined by data quality, saturation, where sufficient in-depth data gave patterns, themes and dimensions of what was studied (Polit & Beck, 2012, p. 521). Time was another factor for how many participants that could be included in the study. Related to a short period for data collection more participants could not be recruited.

Data Collection

Data was collected through personal individual interviews with perioperative RN's. A semi-structured interview is well suited for interviewing a person on a topic that concerns them, to hear their views and opinions, and to guarantee that all participants answered the same questions according to Cridland, Jones, Caputi and Magee (2015). The interviews were based on a study-specific semi-structured interview guide (Appendix 1) which assured that relevant areas for the study were involved (Polit & Beck, 2012, p. 537). To be able to construct the interview guide, the authors familiarized themselves on the subject and asked experienced perioperative RN's who had worked with RAL how nursing care proceeded in such an OR (Kallio, Pietilä, Johnson & Kangasniemi, 2016). The guide was then based on the patient's intraoperative care needs according to Tolleruds et al. (1985) model, which was considered suitable for the purpose of the study.

In the model (Tollerud et al., 1985), the main areas of patient safety, aseptics and environment, work management and teamwork constitute a basis for the perioperative RN's nursing care responsibility. In the beginning of each interview the authors presented the main topics. The participants were then asked to tell their personal experience within the three areas and were encouraged to deepen with help of follow-up questions. Each interview was concluded by asking if the participants had anything they wanted to add to ensure that no important information had been missed (Polit & Beck, 2012, p. 543). The guide was tested to ensure that relevant areas were covered with topics and natural follow-up questions as well as to exclude interview issues (Kallio et al., 2016; Polit & Beck, 2012, p. 537, 541). As no revision of the guide was made, data from the test interview has also been used in the analysis.

Procedures

The authors presented the purpose and execution plan of the study to the head of unit, and a final written approval (Appendix 2) to conduct the study was received shortly thereafter from the ward manager. All perioperative RN's in the surgery unit were informed of the study by email (Appendix 3) to their work-related email addresses about a week before the data collection began. Information about the purpose and execution of the study (Appendix 4), a consent form (Appendix 5) and a link to an online booking system (doodle) where participants could sign up for an interview were attached to the email. During the five weeks

when the data collection took place, the authors participated in two staff meetings to inform about the study and recruit potential study participants. Personal requests for study participation were also made sporadically during the weeks when data collection was performed.

A local distant from the ward, still on the hospital was booked by the authors to create an distraction free environment for the participants (Polit & Beck, 2012, p. 535, 538). When possible, both authors were present during the interviews. One of the authors interviewed the participant and the other, when present, acted as an observer. The length of the interviews varied between 11 and 23 minutes. Recording interviews are recommended by Polit and Beck (2012, p. 534) to reduce the risk of memory bias. The interviews were recorded using either a smartphone with an application for dictation or a voice recorder. Sound recording was used to enable transcription (Polit & Beck, 2012, p. 534).

Research Ethics Considerations

To be able to carry out the study as planned, an approval was received from the ward manager before potential participants were informed of the study, and before the data collection commenced. In accordance with Vetenskapsrådets guidelines (2002), all the perioperative RN's received information about which university the authors and their supervisors belonged to, the purpose of the study and the role of the participants in the project. They were informed that participation was voluntary and that at any time it was allowed to unconditionally withdraw their participation. The information about the study that was sent to the perioperative RN's was designed in a way that was easy to read and easy to understand (Codex, 2018; Etikkommittén Sydost, n.d.; SFS, 2003:460).

In order to strengthen the participants' anonymity, only the authors had access to the names of those who chose to sign up via the online booking system. A written consent was obtained in conjunction with each individual interview. The consent and all interview data have been handled confidentially and only the authors have had access to collected data and recordings, in accordance with the Etikprövningsnämnden (2019). All information and data collected by the study participants will, in conjunction with the final examination and publication of the thesis work in DIVA, be deleted.

The authors reflexivity was evaluated through the data collection period (Polit & Beck, 2012, p. 534) and they discussed their possible personal bias as mentioned in Polit and Beck (2012,

p. 495) when it came to interpret the results. They both conducted the interviews similar to each other. The non-sensitive topics simplified the similarity (Polit & Beck, 2012, p. 521). Cause they were still students it was considered to be a new area for both which in they had little knowledge or preconceptions, it was beneficial to reduce the risk. The descriptive method in itself also prevented a risk of bias according to Braun and Clarke (2006). They still were registered nurses (RN's), one of them came from the oncology department and the other one from primary/acute care. With one respective four years in the profession, they had formed some kind of preunderstanding, this was taken in account when the result was put together (Polit & Beck, 2012, p. 512).

Processing and analysis

The audio files from the interviews were transcribed by the authors, who transcribed half of the interviews each, using the software Express scribe. As an analytical method, thematic analysis (TA) was used, which according to Braun and Clarke (2006) can be used advantageously in several different areas as it is flexible and user-friendly. Since the method is descriptive, and above all intends to describe rather than search for underlying sentences, it is particularly suitable for unexplored areas.

The method was used to identify, analyses and present patterns (themes) in the transcribed qualitative data (Braun & Clarke, 2006). The method organizes the data set in rich detail, but also interpret various aspects of the area, by taking out themes. What is important in relation to the research question in the data counts as a theme. The authors opted to do a rich description of the data set rather than a detailed account of an aspect because of the under-researched area as recommended by Braun and Clarke (2006). They chose a semantic level to look on the themes in the explicit or surface meanings of the participants were the analysis goes from description to interpretation of the content.

The analysis begun when the authors started to look for patterns of meaning and ended with reporting of the themes in the result part (Braun & Clarke, 2006). It is a step by step procedures consisting of six levels. In the first step, which was conducted individually, the authors got acquainted with the empirical knowledge by actively reading through the material and recording what was interesting for the study. Relevant aspects in relation to the research question were sought in step two, still individually, wherein text was highlighted and codes were noted into the pages margin. Now authors compared their marked extracts and codes.

Altogether, step two generated in 273 codes, see example in Table 2. These were entered into a spreadsheet where each code was linked to its extract in the transcript. In step three, relations between the codes were checked in a joint analytical discussion between the authors. Codes that were linked together were grouped as a theme.

Table 2. Data extract with codes applied

Data extract	Coded for
... Yes it happens quite often that they put on their arms on the trocars and then they start working and then you see that "oh, here it was tight" with the arm and you have to go and feel and look and tell them so we get to raise the arm or so, so that.	<ol style="list-style-type: none"> 1. robot arm does not get room to work 2. you (<i>perioperative RN</i>) have to check

After they were created, they were reviewed in step four. Each theme's codes were read and checked against linked quotes. Different themes have been distinctly separated from each other and deficient themes were sorted out (insufficient data, not relevant, etc.). The levels in this step were further subdivided or pooled as needed. This generated in totally three themes; Provide physical safety for the patient; Maintain aseptic, controlled environment; and Nursing management and teamwork. Provide physical safety for the patient consisted of three subthemes; Positioning; Patient guardian; and The missing patient. In step five, all themes were named according to a structure of interest for the research question and in text it was explained why it was interesting for the context of the study. In the last step, step six, the results were compiled in order to answer the aim by taking out extracts that captured the essence of the point that we are demonstrating thru our story.

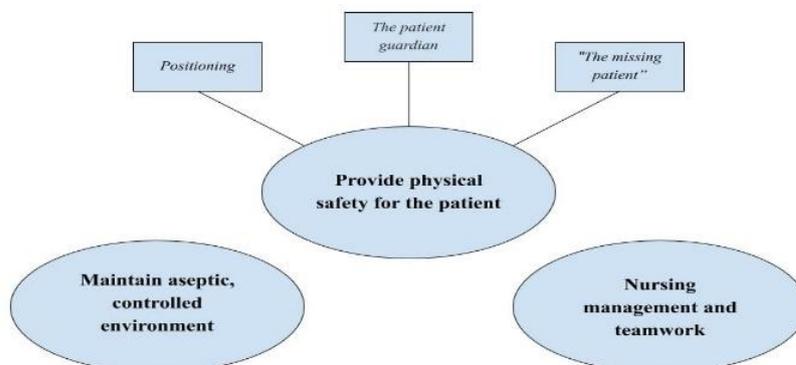


Figure 1. Final thematic map, showing final three main themes

RESULTS

Provide physical safety for the patient

As part of the intraoperative care of patients undergoing RAL, it was necessary to ensure their physical safety during positioning. The participants described the requirements for positioning as something that could be interpreted as unique to RAL, a challenge to the patient's physical laws and limitations, and a need for aids that were both necessary to help but which in themselves meant a risk factor.

Positioning

The position that the patient usually resides in during RAL differs from the positioning in other surgery. The patients were placed far down on the table with their legs wide apart, suspended in leg rests and with a sharp flexion in the hip. The operating table together with the patient was then tipped in deep Trendelenburg mode. This positioning was required for the robot to gain access to the surface and working angle needed. Positioning in RAL was extreme and very strenuous for the patient. The amount of time the patient spent in this position was considered a risk for their postoperative outcome and it was influenced by RAL, where both preparations included as nursing measures and the operative time were longer compared to other surgery. These factors together prolonged the patient's stay in the OR.

It is a very extreme positioning compared to many other surgeries, just because the patient is lying with their head almost down in the floor we tilt the patient before the surgery, and it looks so brutal, I think. (P4)

... you often need to position the patient out a bit, uhm, the table usually ends at the lower back so a piece of the buttocks must hang out and this is because the robot must be able to get in properly and be able to reach with the arms ... (P1)

Positioning a patient in the Lithotomy-Trendelenburg position before a RAL could be both complicated and challenging. Despite the fact that assistance was available from other professions, the positioning was still not always satisfying.

And also, we always have assistant nurse technicians (staff that helps in positioning the patient) if you feel insecure and so. But sometimes it feels like whatever you do, it doesn't get quite good. (P4)

When positioning in Lithotomy-Trendelenburg, the tilt and pressure constitute obvious risks for the patient. Pressure on the patient was inevitable, which made it difficult to prevent injuries occurring. There is a support cushion that prevents the patient from sliding off the operating table when tilted that caused pressure against the shoulders. To counteract pressure

injuries, it was important that no unevenness occurred between these two surfaces.

Positioning of the leg supports entailed a risk of pressure on the patient's legs, heels and toes if they were strapped in too tight or too loose. There was also a risk of stretching the hip joints because the leg rests are lowered in relation to the opposite slope of the body.

It is especially this pressure on the shoulders. Many say that they are hurting afterwards. (P5)

Yes, so leg support is also a risk of nerve damage and such Ehm it's just this pillow at the shoulders that I think is, it feels like, it doesn't feel fun I don't think, but at the same time, it fulfills its purpose (laughter). (P4)

In addition to pressure, shearing of the patient's skin and adipose tissue occurred due to gravity when they were tilted. A certain shearing effect always occurred, even if the patient was positioned completely adequately. Overweight patients were at a higher risk of injury as their superficial fat tissue gave an increased shearing effect.

... and if you have a little higher BMI you have more subcutaneous fat and fat in general which means that when we tilt then it is not only that you slide but then you move yourself on the fat as well ... (P1)

The positioning could be more challenging if the patient had prosthetic implants in, for example, their hips or knees. When the patient's arms were placed against their body, there was a risk of peripheral entrapments pressing against the patient's hands and arms. To avoid pressure injuries, the bedding underneath the patient must be suitable, folds on the sheets, clothing and shoulder support must also be smoothed out. The inevitable pressure and shearing effect eventuate in postoperatively pain for the patient.

... you have to make sure that the pressure is not too high, at the same time as it is inevitable that there will be pressure, so it, as well as you already have a problem or what to say (laughter) but you try to minimize as much damage as you can sometimes it almost feels like whatever we do, you can't always avoid injuries. (P4)

Along with aids being used during patient positioning, it is feasible to use different operating table pads to try and counteract the shearing effect. Some operating table pads were made of material that holds the patient in place, however, these materials could complicate transferring the patient between the bed and the operating table. The shoulder support helped keep the patient in place, although it fulfilled its purpose, the pressure on the shoulders could cause nerve damage. The support has two different facings, one hard and one soft, which made it important that the support was placed correctly. To reduce pressure, vulnerable regions such as shoulders and hands were padded. Despite the use of aids and pressure relief, according to perioperative RN's, many patients experienced postoperative pain in the shoulders.

... it is a pillow at the neck that they have, many have been injured by that from what I understand, it becomes a high pressure ... (P6)

When the robot was docked in place and the operation commenced, it could be difficult to reposition the patient in a patient-safe manner. It was therefore important to confirm that the patient was positioned correctly from the start. The leg supports had to be individually adapted for each patient and sometimes needed to be adjusted during the operation. If the positioning needed to be checked during the operation, the staff could enter under the sterile drapes to be able to perform this control. In more rare cases, the robot could also be undocked from the patient if the positioning was not satisfactory and repositioning was required.

And just that you can't get to the patient when the robot stands there because then it is, and it's a pretty big project to lift off all the pliers and back up and, mm. (P2)

... And just when the robot is in place since then you can't do anything like, you can rarely do that in other surgeries either but it is just a little more flexible. (P4)

Because positioning of the patient was complicated, it was one of the most time-consuming steps for RAL, and due to its importance, it could not be rushed. The perioperative RN must plan and prepare their nursing actions in a completely different way in RAL.

So, I think it's almost half like the job for me, during these surgeries, making sure the positioning is good. (P4).

... Yes, it does because it takes time to position the patient, so that is why. And just this with padding and all such stuff so, that's what takes time. Eh, so then it differs. (P5)

The operations usually took longer than conventional laparoscopy. If the operative time became too long, an appropriate nursing action was to pause the operation and level out the patient in a less extreme position.

Yes, but you can get nerve damage from it, now I do not think it is so common but for some interventions the longer time than others and the longer they are the bigger the risk is that it will. (P2)

... when one takes the glands both peritoneally and from the pelvis which usually becomes a full-day surgery where the patient is in this position for maybe up to six hours and then it is important that you remember that you have to pause, level the patient. (P1)

The patient guardian

The perioperative RN's considered themselves to be responsible for patient safety, having guardian roles in preventing mistakes and protecting the patients against physical harm as part of the intraoperative care. With this awareness, there were several elements and risk factors for acute injuries that they had registered needed to be avoided. The robot could not register on its own if its arms were pressed against the patient, and this posed a risk for the

patient's physical safety. Incorrect positioning of the patient on the operating table or in the leg supports could increase the risk of the robot's arms pressing against the patient.

Yes, it does for those arms they tug and sometimes, so you have to check all the time so that they don't squeeze and press the patient on the legs or on, yes where, ... (P2)

Where the robot's arms and instruments were closest to the patient, space was cramped, and it could be difficult to see if the robot pushed the laparoscopic trocars down towards the patient. The robot's arms moved around their own axis and would not suddenly cause pressure on the patient, but if the perioperative RN's were not there to perform their duties, the risk of pressure would have been greater. The patient's arms were padded and placed in rails adjacent to their body to protect them from pressure from the bulk of the robot, and reduced the risk of the patient's arms being injured if the robot was repositioned during the operation. The patient's hands were also padded because the leg supports, if positioned incorrectly, could collide with and squeeze the patient's hands or fingers.

The hands are often hanging out so that, they also, have to think about the leg supports when they move so that they don't pin hands and fingers, eh, the leg supports also ... (P1)

And even during the surgery, the leg supports have happened, the leg supports themselves have collided with hands. (P3)

The perioperative RN continuously checked for pressure on the patient, but when it was tight in the region where the robot and the patient met, it could be difficult to see if pressure occurred, especially against the patient's legs. It was also difficult to see what was going on the opposite side of the patient. The perioperative RN may therefore have to walk around the robot to be able to perform their controls. When visual inspection was not possible, the perioperative RN's needed to use their own hands to feel how much space there was between the robot's arms and the patient.

It is like a routine one has, I think, that one checks it, ehm so that's probably. But it is clear that it is difficult to see at times, so therefore I always go and feel like, under the arms like this ... for it might look okay but you never know. (P4)

... but just that you don't really know if it's pushing something on the other side because you can't stand there all the time and check, it is kind of what I think is most uncomfortable about not having control, otherwise they lie pretty good. (P6)

"The missing patient"

There was a concern among the participants that they would forget that there was a person under all material. When the patient was covered in sterile drapes, in combination with the robot being large and other equipment obscuring the view, it was not much of the patient that was visible. This made it difficult to see the positioning of the patient or if joints were

overstretched. Sometimes the patient was not visible at all and, for a short time, it was forgotten that there was a person hidden under all material and equipment.

... when the draping is on it does not show, how much tilt it really is and you do not really see the patient so it is a little scary I think to know if they stay in place. (P6)

... you may have to adjust the position of the patient because it touches and then you may not have equal control because then it is washed and dressed so then you do not see as well, oh did it become a little over extended now the leg or ... (P2)

Maintain aseptic, controlled environment

One of the perioperative RN's primary care measures was to maintain asepsis to avoid cross infections, which could be more challenging during RAL. In addition to the patient and operating table being sterile draped, and the perioperative RN and the first assistant being in surgical scrubs, the robot and other apparatus must also be covered in sterile draping. It was difficult for the person who steered the robot into place to see and navigate on their own, and it was therefore a risk that the robot was unsterilized during this moment. As the robot, together with other apparatus, took up a lot of space in the OR, the OR's sterile area was larger and the unsterile area around it became smaller.

... it is clear that it is more stuff you need to like dress sterile than on a regular operation, ehm and you need to have like greater control on everyone in the room just because there are many who can walk into the robot when it is sterile draped ... (P4)

Maintaining asepsis in some operations were more difficult, as some surgeries required more space due to the robots positioning. Due to the size of the robot, there was a risk that its sterile parts would reach luminaires and other fittings and suspensions. Along the ceiling from the robot, the unsterile cords go to, among other things, the unsterile consoles where the main operator was positioned. When several people were present in the OR, or when equipment needed to be repositioned during surgery, entailed risk moments for asepsis.

... much harder, because it is cramped and small and sometimes a lot of people and the robot takes a huge place, and it is a small OR, so yes it's really difficult to keep track of everything, especially on the other side where you are not standing. (P6)

The working position could sometimes be both difficult and non-ergonomic for the perioperative RN, especially in view of maintaining asepsis in correlation to the tight space around the patient and the robot. However, it was hard to get around the fact that space was cramped directly around the patient. When it got difficult to see in the robot's area, the perioperative RN's would sometimes have to walk around the robot to be able to perform their tasks. A crowded OR and a limited area around the robot could make it more difficult for the perioperative RN and the team to maintain asepsis of themselves and the robot.

Furthermore, due to the narrow working surface of the robot and the patient, when the perioperative RN's performed their tasks, it could easily happen that their surgical cap made contact with some part of the robot's arms, or that one of the arms hit the perioperative RN in the head. When this happened, it was usually on the parts of the robot's arms that were furthest away from the operation area.

... if you stand there and barely reach and then you have to crawl in a bit below to be able to push and then you have to accept that the part of the arm that is closer to the robot, the body of the robot, it has to become unsterile because we have to be able to practically do this. (P1)

The anesthesia staff was separated from the sterile area by a semi-translucent sterile sheet, and sometimes, due to the narrow space, the perioperative RN's would involuntarily bump into this sheet with their heads.

... you bump your head into that sheet or even into the robot because you work a lot with like getting access to the trocars and to change the instruments and then like you dive down a bit like this (shows with body language). (P4)

Since asepsis was difficult to maintain to a hundred percent, there was some acceptance to the fact that some things would become unsterile and instead make efforts to work around it. It was important that the perioperative RN knew what could become unsterile and kept track of what areas had already been contaminated. Certain tasks could be very difficult for the perioperative RN to perform without touching some parts of the robot. In contrast and due to a robot instead of a human being closest to the patient and the operation area, the area closest to the wound became more sterile than in other surgeries.

Also, I think the robot works pretty well here, that everyone is aware of this but then it is a bit like that sterility during surgery yes it should be maintained but sometimes you cannot have one hundred percent because it, it simply doesn't work. (P1)

... So then it is very much like that, fiddly things, but on the patient's sake the asepsis, so I think it is great, that it is kept clean and so because all instruments and the robot's arm are sterile and there is no danger in this way. (P3)

Nursing management and teamwork

The patient's intraoperative care in RAL is dependent on the perioperative flow. Being a perioperative RN performing a preoperative conversation was one of the prerequisites that the participants addressed, and they deemed that postoperative follow-ups were important in order to be able to evaluate the nursing measures they performed. Viewed from a perioperative perspective, there were some missing pieces that the perioperative RN's needed to adequately satisfy the patient's intraoperative nursing needs.

Due to the extreme patient positioning, it is important to have a preoperative conversation to get insight of the patient's skin quality, mobility in the shoulders and legs, and potential pain conditions. It was considered good to inform the patient that the positioning is extra strenuous. The perioperative RN must not forget that they, in their foundation, are registered nurses, and that the specific nursing care must be designed in consultation with the patient.

So it is important also that you have a communication with the patient before that, how is your mobility, what can your joints handle and for example do you have pain since before in the shoulders or elsewhere, so then it is important that the patient knows that they will be in a position that will be extra strenuous, because it is not that strange if you wake up and have a little cramps everywhere, especially in addition you can get pain in the shoulders and stuff just by the gas as well. (P1)

Teamwork was an important factor for nursing care and patient-safe results, the whole team being more involved with a shared awareness and responsibility for the patient. A cross-border collaboration was preferable to maintain asepsis and to ensure the patient's physical safety. Since the technology has led to that different professions no longer work as physically close together, the communication in the OR where RAL was performed differed, and measures have been designed to create and maintain good communication in the surgical team. There are monitors set up where the perioperative RN and the first assistant can see what the surgeon sees in his console and thus follow along in the operation. However, at certain moments it was difficult to see those screens as space was limited. The surgeon's console was equipped with a microphone to facilitate communication with the other members of the team via loudspeakers, but as some surgical equipment produced noise it could sometimes be difficult to hear. Furthermore, different people in the surgical team did not always see what other members were currently working on, which led to a lack of understanding for each other and a poorer cooperation as communication deteriorated.

You can notice that the assistant sometimes finds it difficult to hear what the surgeon is saying and usually have to double-check yeah but you don't see what the other person is doing so you get less understanding for each other, I feel that anyway. (P6)

Yes, it is different, yes, it's, yes, I do not know, it works but you sometimes feel a bit like that, not alone but you have to look the screen and, since you only hear the sound when the surgeon is talking. (P3)

Those interferences created an environment where the surgical team automatically used clearer forms of communication and double-checking relayed information to avoid faults and shortcomings.

... eh but I think it's clear that you can get better at this feedback that "Yes, I have done that now!" kind of So, they don't have to like "Did you do that? Did you check that?" like this ... (P4)

If the first assistant was not as experienced or lacked experience, parts of their areas of responsibility would fall on to the perioperative RN, suddenly increasing their workload. It was therefore important, for patient safety and before the operation, to clarify what competence was in place and who was responsible for different tasks. The time it took to arrange and make preparations between two operations could vary widely depending on the staff's experience in RAL.

Now recently there have been many inexperienced assistants and then a lot have been placed on us. (P6)

There is no feedback from the department where the patient is placed for postoperative care. Since the perioperative RN's don't meet the patient during their postoperative stage, it is not possible for them to evaluate and improve their intraoperative nursing measures without receiving patient-specific feedback.

Ehm, we have had some cases of nerve damage for example. And it can be difficult to know how to do it better because, right now, they have not seen how to solve it. (P4)

... I don't know how the follow-up is, because that is a disadvantage in surgery, you know and you do what you think but you do not get any feedback from the ward that ... (P2)

DISCUSSION

Results discussion

The patients intraoperative care was affected by RAL in several ways. For the perioperative RN, there was a lot to keep track of in order to maintain asepsis and to ensure the patient's physical safety. The positioning of the patient was important in order to avoid pressure ulcers and press-related pain injuries, as well as over-stretching and nerve damage. RAL meant a larger sterile area in a narrower environment where it could be difficult to get an overview and maintain sterility. If team members were inexperienced, the perioperative RN's role and responsibilities could be expanded outside their comfort zone which could lead to a risk for patient safety. There was a general problem with the follow-up in the postoperative phase. It was difficult for the perioperative RN to know how performed nursing measures worked since they did not meet the patient afterwards and since there was no routine for follow-up between the postoperative unit and the surgical ward.

Results relevance in relation to previous research

The requirements for positioning were described as something that could be interpreted as unique to RAL. It is in line with the literature where dorsal lithotomy-Trendelenburg with a 30-degree gradient is only described related to RAL (Rothrock & McEwan, 2012, p. 175). The slope was associated with a challenge to the patient's physical laws and constituted an obvious risk of pressure and shear damage as shown in previous research (Bauer et al., 2014; Demasi et al., 2018; Gezginci et al., 2015; Johansson & von Vogelsang, 2019; Yamada et al., 2016). As a measure some studies show that a reduce of the slope with as little as two degrees can make a difference for the patient outcome (Gould, Cull, Wu & Osmundsen, 2012; Takmaz et al., 2018). This could reduce the problem of postoperative pain conditions for the patients as the perioperative RN's experienced the threats mainly came from shear and pressure caused by the slope. The participants stated that assistive devices for positioning were necessary. They also posed a risk of causing more injuries to the patient, especially if they were not used correctly. Research confirms that aids are necessary to position the patient safely. There is a knowledge gap in the design of these which means that there is no evidence for the aids used (Maerz et al., 2017; Talab et al., 2016; Takmaz et al., 2018). According to Talab et al. (2016) they do not even have approved product labelling in accordance with the directives that apply to medical technology products. Thereby standardized working methods fails with several disadvantages (Talab et al., 2016).

The perioperative RN's stated that half their work with RAL was about preparing the patient. The complexity of adapting the positioning to the patient's conditions and the robot's requirements was what was most time-consuming. Preparing the best way for the patient not only meant a paradox as to the use of aids but also for the time. Time was required to position safely, but time is also crucial for the occurrence of postoperative pain conditions (Bauer et al., 2014; Demasi et al., 2018; Gezginci et al., 2015; Johansson & von Vogelsang, 2019; Yamada et al., 2016). There is evidence that standardized working methods reduce the time spent on preparations (Alfredsdottir & Bjornsdottir, 2008; Hortman & Chung, 2015; Kang et al., 2016), this was nothing the participants mentioned to have followed in their wards. Maerz et al. (2017) claim that the pain limit of the surgical length goes at 240 minutes. The participants were aware of the prolonged operative time at RAL and stated that a measure used in very long surgeries was to pause the operation and level the patient. The measure is supported by Hortman and Chung (2015). However, this in itself is a time-consuming task. It is not possible to reposition the patient without first undocking the robot the results shown, which is supported by Talab et al. (2016).

The perioperative RN's were known to have guardian roles to prevent mistakes and protect the patient against harm as part of the intraoperative care. In Tolleruds et al. (1985) model this is one of the main tasks of the perioperative RN. In this kind of environment, there are several potential threats and it places high demands on the perioperative RN's ability to detect them before they occur (Alfredsdottir & Bjornsdottir, 2008). The participants had noticed the robot's contact pressure from its arms and body as a recurring problem. This is only noticed by a few other studies (Calianno, 2007; Kang et al., 2016). Depending on how the operating table is designed, there was also an imminent risk of squeezing the patient's hands during repositioning of leg supports. This could have been a local problem since it was not possible to find any previous research within this field.

The perioperative RN's pointed out that the preoperative conversation was of the utmost importance in order to be able to position the patient. In connection with the preoperative conversation, the patient's physical abilities would be tested in a waken state so that they would be able to mediate existent physical limitations. This way, individually positioning each patient while they were awake could reduce pain and neuropathic damage, and also promotes the patients' participation in their individual intraoperative care (Alfredsdottir & Bjornsdottir, 2008; Chitlik, 2011; Ginsburg et al., 2018). Being a perioperative RN was a key factor in being able to carry out a good care for the patient at RAL. With this competence, an awareness of the patient as a human being follows according to Tollerud et al. (1985). However, the holistic perspective was made difficult by the fact that the visible person almost completely disappeared under draping material and bulky apparatus. It has been recognised as a problem in a previous study by Maerz et al. (2017). It can be argued that the holistic person-centered perspective, have to stand aside for a more patient-centered focus inside an OR to maintain a good flow (Bull & Fitzgerald, 2006). This must not necessarily be a problem, since the patient-focused flow still includes nursing acts mainly consisting of measures for physical patient safety (Tollerud et al., 1985). An acute problem with the patient not being adequate seen was that he or she could get improperly posed.

Another of the perioperative RN's primary care measures is to maintain asepsis to avoid cross infections. Still there were a lack to prior research on how the sterile environment is affected by RAL. The participants mentioned that there was more apparatus that needed sterile draping and several unsterile components that were bulky. As a result, the sterile area was larger and the unsterile area around it became smaller, as they competed for space. This tells us, supported by Ahmad et al. (2016), that traditional design of the OR is probably not

optimal at RAL, a larger OR should be considered. At some of the work moments it was common that the robot got unsterile by the perioperative RN's head, although it was consciously and distant from the surgical area. In contrast, there existed an idea that the area closest to the surgical wound was more sterile than in other surgeries related to the fact that it was the robot's arms who were closest to the patient instead of the surgeons.

The communication was somewhat different related to the scattered team and the technological conditions. This led to closed-loop communication (CLC), often and unknowingly being used (Härgestam, Lindkvist, Brulin, Jacobsson & Hultin, 2013). Neither looking nor nodding could confirm that one had understood what the other one said, that was why call-out, check-back and closed loop were implemented. It is rare for CLC to occur spontaneously without training (Härgestam et al., 2013). Teamwork was an important factor. The whole team where more involved and a cross-border collaboration was preferable, consistent with previous research that states that the entire team is responsible for promoting patient safety and preventing injuries regarding the patient's positioning on the operating table (Hortman & Chung, 2015). There was a shared awareness and responsibility for the patient where the perioperative RN's in the study worked. The perioperative RN has a certain responsibility in getting the team to work according to Mathew et al. (2018). Working with a previously experienced team in this type of surgery seem to reduce complications and promote work ethics and trust within the team (Alfredsdottir & Bjornsdottir, 2008; Allers et al., 2016; Kang et al., 2015; Tse et al., 2017).

The literature states that there is an urgent need for more education for perioperative RN's who will work with RAL, that a specialized education can be an alternative to ensure patient safety during these operations (Kang et al., 2016). The participants did not talk about the lack of knowledge and education as a problem rather when other professionals' skills failed. The perioperative RN would then become burdened with work and he or she may have to perform tasks that they did not had education for. This was mainly when the first assistant was inexperienced. An increase in workload can have a negative influence on both teamwork and patient safety (Christian et al., 2006). A good collaboration between the other team members can in that situation make it easier for the less experienced to get in and get a good introduction (Allers et al., 2016). In order to create the best teams, team training is suggested as the main action, as it improves both efficiency and increases patient safety (Allers et al., 2016; Mathew et al., 2018).

A preoperative conversation and evaluation of the patient's capability was crucial to maintaining the patient's physical safety. The perioperative RN's intraoperative responsibility for the environment and asepsis to counteract post-operative infections as well as the ability to work in teams and have a guiding role for the patient's care were also crucial. These components fall within the scope of Tolleruds et al. (1985) model. The participants addressed that not being able to evaluate their preparations prevented them from living up to the perioperative concept and posing a risk that the patients did not receive the best possible care. In the model (Tollerud et al., 1985) the patient's mental status is discussed, especially during procedures where they are awake. The participants stated that they met the patients awake when they were placed on the operating table where the positioning was tested to ascertain what was physically possible and what was not. It is not clear from the interviews whether the patients were also awake during the test tilt. It would be of interest for further research to interview patients to illuminate their experience of RAL.

Clinical implications

The study contributed with new knowledge about the nursing care of the patient undergoing RAL. The complex work with position the patient needed to be evaluated thru follow-ups between the surgical ward and the postoperative ward to make sure that best possible care was given. If a reduction of only two degrees would suffice to reduce the risks to the patient's physical safety (Gould et al., 2012), an exact setting operating table would be preferable or a stop that prevent to slope steeper than 28 degrees. The time-consuming task to prepare for the operation was in itself a risk and a standardized working procedure for positioning could make the time and measures more efficient (Bauer et al., 2014; Demasi et al., 2018; Gezginci et al., 2015; Johansson & von Vogelsang, 2019; Yamada et al., 2016) and reduce the time the patient spend in steep slope and exposed position. The participants did not mention any listed guidelines, but all had a similar way of working within the framework of their roles. Checklists are recurrently mentioned in the literature as a way for the perioperative RN to streamline and work patient-safe (Alfredsdottir & Bjornsdottir, 2008; Kang et al., 2016; Mathew et al., 2018). The authors suggest that wards working with RAL make sure that continuous updated evidence-based guidelines exist.

It revealed work steps that meant that the robot's arms were contaminated by the perioperative RN's head. It seemed to be unique for RAL that the perioperative RN's contaminate sterile areas with their heads. Previous studies (Haskins et al., 2017; Kothari,

Anderson, Borgert, Kallies & Kowalski, 2018) mean that there is no correlation between the type of surgical cap carried by the surgeons and post-operative infections. There is no literature on whether the post-operative infections at RAL could be affected by what type of surgical cap perioperative RN's wear. This could be something that impacts postoperative complications as infections.

With lack of competence in the team the perioperative RN's might need to work outside their comfort zones which can entail risks for the patients and earlier literature believes that there is an urgent need for the perioperative RN's to get education within RAL (Kang et al., 2016). We suggest that the best effect with a holistic perspective would be team training, where training on events relevant to RAL would give every team member an understanding for each other's work (Allers et al., 2016; Mathew et al., 2018). Communication at RAL had a unique structure compared to conventional surgery related to team members primarily not communicating face to face. It gave CLC (Härgestam et al., 2013) automatic use. At the same time, when transmitters and receivers did not see each other, communication could be obstructed with misunderstandings, which is a danger to patient safety (Christian et al., 2006). Implementing CLC as a standard for communication in this type of environment could be relevant and increase understanding of each other and reduce misunderstandings.

The societal perspective and ethics

International council of nurses ([ICN], 2012) states that nurses' primary responsibility is to provide care for human beings in need. Nurses should initiate and promote work that contributes to that. Robotic surgery was seen by the participants as a positive development, although at present it could be weight between the surgeon's benefits and the nursing difficulties in certain aspects. Robot-assisted procedures were inspiring. The inspiration that the participants experienced may be related to the understanding of technology in healthcare as a phenomenon. A phenomenon that can improve the nursing care, the patient experience and the development of science of care (Barnard & Gerber, 1998).

With new technology and research, the nurse's responsibility is expanded. Nurses needs to make sure that care is in accordance with patient safety, dignity and rights (ICN, 2012). The participants meant that for the patient outcome, the movements of the robot instruments are more gentle and safer, and postoperatively, it provides a better quality of life. It is in line with the research that states that the surgical method involves low and often even lower

complication risks than in laparoscopy and laparotomy, which means shorter hospital stay for patients (Ahmed et al., 2012; Catchpole et al., 2016; Leow et al., 2014; Liu et al., 2014; Maerz et al., 2017; Mathew et al., 2018; Medical Advisory Secretariat, 2010; Mir et al., 2011; Trastulli et al., 2015; Tse et al., 2017). The concept of human was reflected primarily under the theme "The missing patient" where perioperative RN's risked, presumably together with the other team members, to lose the holistic perspective of the person who barely appeared visible on the operating table. It is on the nurse's shoulders to promote an ethical approach and keep an open dialog in the team to make sure the patient is not forgotten (ICN, 2012).

In the description of competence for perioperative RN's (RFOP & Swenurse, 2005) the perioperative RN's are in head charge over the aseptic environment, this mean that they also have the main responsibility for this area. The study shows that the environment in RAL differed from the conventional surgery, mainly because the sterile area had increased at the same time as there were more unsterile components inside the OR. The aware contamination of the robot is problematic and should be evaluated more.

To prevent the emergence of health-related injuries and complications in accordance to the perioperative RN's responsibility (RFOP & Swenurse, 2005) they need to evaluate health, the patient's health relative to nursing. This was problematic because there were deficiencies in the perioperative chain. In order to live up to person-centered care the perioperative RN must be able to follow the patient's journey through all the perioperative phases (Arakelian, Swenne, Lindberg, Rudolfsson & von Vogelsang, 2017). The problem with the perioperative phases can be based on a lack of definitions of the role of perioperative RN (Espinoza et al., 2016). By defining the role, quality improvements could be made that ensure a person-centered care and best outcomes for the patient (Arakelian et al., 2017; Tollerud et al., 1985).

As the perioperative RN's in the study mentioned they could end up in situations way outside their comfort zone, meaning that they could be responsible for carrying out sub operations they did not have training for if the first assistant was unexperienced. This could lead to working without an evidence-based approach and is in direct contrast with the description of competence for perioperative RN's (RFOP & Swenurse, 2005) but according to ICN (2012) the nurse should make sure to intervene when colleagues risks the patient safety. In a longer perspective the nurse's duty to support and develop colleague's ethical knowledge could promote this kind of events. This should not lay on the perioperative RN's alone it is a

manage question on an organisational level, but the nurses should be able to assess their own and others competence (ICN, 2012) and mediate their knowledge to closest supervisor.

Method discussion

Strengths & debility

The advantage of using qualitative design is that it's flexible and able to be adjusted during the study. It is also holistic and tries to describe the entirety. A disadvantage could have been that it's more dependent on those who carry out the study because they also become the instrument, such as interviewers, in this case two students without any great experience of interviewing or conduct analysis (Polit & Beck, 2012, p. 487, 522). It can be discussed whether the analysis in itself, in a study where a descriptive exploratory design with inductive approach that does not go into an interpretive depth but presents comprehensive summaries of an event, should be viewed as complete (Polit & Beck, 2012, p. 505). According to Sandelowski (2000; 2010, quoted in Polit & Beck, 2012, p. 505), the design also tends to be eclectic. The authors of the study have nevertheless chosen to use a descriptive analysis method to study a previously unexplored area (Braun & Clarke, 2006). Content analysis could have been a valid option, but according to Braun and Clarke (2006) with support from other researchers (Vaismoradi, Turunen & Bondas, 2013), TA is often better suited and particularly good for unexplored areas since the method above all intends to describe rather than search for underlying sentences.

Ethical considerations

The interviews were conducted in a room adjacent to the ward where the participants worked, for logistical reasons. Most interviews were conducted shortly after the participants had been asked to participate, at the time this was the only room the authors had access to that was readily available, and that did not require to be booked in advance. From a privacy and anonymity perspective, it would have been better if the interviews were conducted further away from the ward. The online booking schedule that was linked in the informative e-mail was anonymous, and only the authors had access to the names of those that would sign up in that system. However, no one registered via the system, but all participants were recruited through personal request during the data collection weeks.

Need for further research

To the best of our knowledge this study was the first of its kind and generated in a potential platform for future research. Although positioning being crucial for the patient's physical safety, there is a lack of documented guidelines and routines on this subject (Talab et al., 2016). Innovations for assistive aids and methods have not kept up with the current rate of surgical method development (Takmaz et al., 2018; Talab et al., 2016), and current aids used in positioning are not without risks (Talab et al., 2016). Further research is needed to obtain new knowledge, techniques, and guidelines, to counteract the risks of patient injury that the positioning has in RAL.

Trustworthiness

The first two steps of the data analysis were done individually by the authors, to be compared later. According to Polit and Beck (2012, s. 584-585), this increases the trustworthiness of the result. On the unit where the robot was located, there were only few perioperative RN's who worked with it. In order to get more study participants, the authors have had to make a multicenter study where several hospitals would have been included. This was not considered possible within the timeframe and not necessary for such an unexplored research area only just being explored. Since the population was of limited size in relation to the topic, it can be argued that the sample size was insufficient regarding data saturation which could have had impact on the credibility (Polit & Beck, 2012, s. 521). As mentioned the study was performed at a single university hospital, there was a risk that experiences described by the participants can be due to local phenomenon's and routines (Polit & Beck, s. 516) but since there is only one supplier of robot systems on the market today, the study's results could potentially transfer to most of the clinics where RAL is used.

Conclusion

The patients intraoperative care was affected by RAL. The difficulties with preparations and positioning were risk factors for the patient, in contrast with the advantages of the surgery for the same. This could however be improved and developed with the help of guidelines and follow-up according to earlier research. The authors states that further research is necessary for the aids that are being used as well as for the aware contamination of the robot. Overall there were a gap in the research area between surgery and nursing. The study showed the urgent need for health science to keep up with medical research regarding RAL.

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Appendix 1.

Interview guide

- How is the patient's physical safety ensured?
 - Positioning
 - Similarities differences
 - Risks

- How is aseptic and environmental control maintained?
 - Work / ambient
 - Similarities / difference
 - Risks
 - Asepsis

- How does work management and teamwork work?
 - Supervision / teamwork
 - Communication
 - Similarities / difference
 - Risks

Is there anything you think we have not addressed that should be included?

Appendix 2.

ANSÖKAN OM ATT GENOMFÖRA EN STUDIE

För ansökan om genomförande i primärvård, se www.lul.se/pvansokanstudie



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Sjuksköterskeprogrammen samt för fristående kurser inom vårdvetenskap/folkhälsa

ANSÖKAN OM TILLSTÅND FÖR ATT GENOMFÖRA EN STUDIE INOM RAMEN FÖR EXAMENSARBETE

Preliminär titel:

Studiens design: se bifogad projektplan **Tidpunkt för datainsamling:**

Namn:

Program / Kurs:

Termin:

Gatuadress:

Postnummer:

Ort:

Telefon:

Handledare:

Gatuadress:

Postnummer:

Ort:

Telefon:

Tillstånd för att genomföra ovanstående studie lämnas härmed och studien bedöms utgöra en del av det kvalitetsutvecklingsarbete som bedrivs inom kliniken och anses därför ej behöva granskas av Medicinska fakultetens forskningsetikkommitté

Tillstånd för att genomföra ovanstående studie lämnas härmed men studien bör granskas av Medicinska fakultetens forskningsetikkommitté

Tillstånd för att genomföra ovanstående studie lämnas ej

Datum:

Ort:

Namnteckning ansvarig klinikchef/överläkare/vårdcentralschef/verksamhetschef:

Namnförtydligande:

Appendix 3.

Mail till operationssjuksköterskor

Vi är två operationssjuksköterskestudenter som genomför en studie inom ramen för vårt examensarbete. Studien syftar till att undersöka omvårdnadsaspekter inom robotassisterad kirurgi (se bilaga ”informationsbrev”).

Vi skulle vara tacksamma om Du som operationssjuksköterska med erfarenhet från robotassisterad kirurgi har möjlighet att bidra med just Din kunskap. Anmälan till ett intervjutillfälle som passar görs via länken nedan. Intervjuerna kommer ske i konferensrum 2 i läkarskeppet, ingång 70 och beräknas ta ca 30 minuter.

Din medverkan är viktig då det kan bidra med meningsfull kunskap till den perioperativa omvårdnaden vid robotassisterad kirurgi. Studien är den första av sitt slag och skulle kunna generera en plattform för framtida forskning och för kvalitetsförbättringsarbeten inom operationssjukvård.

”LÄNK TILL SCHEMA”

Hittar du ingen tid som passar, hör av dig till oss då vi är flexibla. Intervjutillfällen kan även anordnas på helgdagar om det är att föredra.

Med vänliga hälsningar,

Mathias Blom & Jennifer Båskman

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Appendix 4.



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Förfrågan om deltagande i studien Omvårdnadsaspekter vid robotassisterad kirurgi

Du, operationssjuksköterska som medverkat vid robotassisterad kirurgi, tillfrågas härmed att delta i intervjuer i en studie som är en del av ett examensarbete i specialistsjuksköterskeutbildningen med inriktning operationssjukvård. Studien syftar till att få en bild av om och hur omvårdnadsåtgärderna påverkas under robotassisterad kirurgi. Vi skulle vilja veta mer om patientens fysiska säkerhet, aseptik, miljö, samt arbetsledning och teamwork. Förhoppningen är att studien kan bidra med ny meningsfull kunskap för perioperativ omvårdnad vid robotassisterad kirurgi. Det skulle vara den förta studien av sitt slag och skulle kunna generera i en plattform för ny forskning och kvalitetsförbättringsarbeten för operationssjukvård.

Intervjuerna beräknas ta ca 30 minuter och utförs i lokaler på sjukhuset, utanför operationsavdelningen. Under intervjun kommer det att erbjudas lättare dryck, kaffe och tilltugg. Intervjun är semistrukturerad och kommer utgå från en guide för att säkerställa att vissa specifika områden berörs. Vi strävar efter heterogenitet och välkomnar därför olika kön, åldrar och erfarenhet. Intervjuerna kommer att spelas in för att undvika att viktig information går förlorad. All information kommer att hanteras konfidentiellt och din identitet kommer inte att avslöjas. Du kan när som helst välja att avbryta din medverkan i studien.

Vid frågor, vänligen kontakta Mathias Blom eller Jennifer Båskman.

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Projektets handledare: Birgitta Jakobsson Larsson

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Appendix 5.



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Informerat samtycke

Omvårdnadsaspekter vid robotassisterad kirurgi. Intervjun kommer att spelas in för att undvika att förlora viktig information. Informationen kommer att behandlas konfidentiellt och din identitet kommer inte att avslöjas. Informerat samtycke betyder att du som deltagare går med på att delta i denna studie och att du tillåter att författarna får använda intervjuunderlaget till studien. Vi är inte intresserade av personliga data, utan enbart av upplevelser och åsikter utan relation till personen. Inspelningen och transkript kommer att förvaras där endast författarna har tillgång till dessa. Efter att studien examinerats kommer all insamlad data att raderas enligt Uppsala universitets riktlinjer.

Informerat samtycke: Jag går med på att delta i studien och jag vet att jag när som helst kan välja att avbryta min medverkan.

Signatur och datum: _____

Namnförtydligande: _____

Vid frågor, vänligen kontakta Mathias Blom eller Jennifer Båskman.

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