

Patient experiences of left-sided colorectal resection by robotic, conventional laparoscopic and open approaches: a qualitative study

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This study received ethical approval in our institution.

All patients provided written consent to their participation in the study.

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Jane McCulloch and Gabrielle C Thorpe. The first draft and subsequent drafts of the manuscript were written by Oliver Claydon and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Abstract

Background

Robotic surgery (RS) is increasingly employed in colorectal surgical practice, widening the range of surgical techniques offered to patients. We investigated colorectal cancer patients' perceptions of RS, open surgery (OS) and conventional laparoscopic surgery (CLS), to identify ideas or assumptions which, in the context of shared surgeon-patient decision making, may affect the resultant choice of surgical technique. We also investigated salient factors affecting patients' peri-operative experience, including those of RS patients, to guide improvements in care and pre-operative patient preparation.

Methods

Twenty-seven patients, who underwent resection of left-sided colorectal cancer at a large UK teaching hospital from November 2020 to July 2021, participated in semi-structured interviews 6 weeks postoperatively. The interview schedule allowed discussion around patients' experience of their surgery and postoperative recovery, and their perceptions of surgical techniques. Interview transcripts were coded manually using inductive thematic analysis, and analyst triangulation was employed to refine coding schemes and ensure reliability of emerging themes.

Results

Patients understood the technological benefits of RS but were concerned by a risk of technological failure causing patient harm. OS was understood to be associated with more pain and longer recovery than RS or CLS. Patients perceived CLS to be more technically challenging compared with OS. Less pain and smaller wounds than expected were significant positive factors in the experience of RS and CLS patients specifically. Complications and emotional impact were significant factors in the experience of all groups, for which many patients felt under-prepared.

Conclusions

Patients generally have a positive view of RS and technical innovation in surgery. Concerns mostly centred around failure of technology. Many patients felt unprepared for significant factors in their peri-operative experience. Surgeons and healthcare providers should be prepared to address patients' perceptions and expectations of colorectal surgery preoperatively.

Keywords: Colorectal cancer; Colorectal surgery; Patient perceptions, Robotic surgery, Laparoscopic surgery. Laparotomy

Introduction

Robotic technology has become increasingly employed in the field of colorectal surgery [1, 2]. Studies have demonstrated similar or improved clinical outcome measures for colorectal robotic surgery (RS) versus conventional laparoscopic surgery (CLS), including conversion rate, time to recovery of bowel function, length of hospital stay and postoperative complications [1, 3-5]; and minimally lower rates of urogenital dysfunction [6]. It is conceivable that as surgeons' experience with RS develops, outcomes will improve further, and the technique will become more common in surgical practice.

As RS becomes more commonly used, and the variety of techniques in colorectal practice expands, it is essential that healthcare providers understand patients' perceptions and preconceptions of RS, CLS and open surgery (OS). This is particularly the case with RS about which, as a relatively new technique, patients' knowledge may be limited [7, 8]. As patients exercise more direct involvement in their healthcare decisions [9], a patient's perceptions of a surgical technique, whether justified or not, may influence their preference of technique and therefore the resultant surgery. It is important to identify widespread perceptions of surgical techniques amongst patients, to inform preoperative discussions with patients and to tackle incorrect assumptions.

Furthermore, it is essential that healthcare providers understand the salient factors affecting patients' subjective experiences of surgery; so that patients can be properly informed and prepared during preoperative discussion, and that action may be taken to improve perioperative care. Is it important to determine whether experiences of surgery differ by technique, or are common to all techniques, so that focused intervention can be made. In particular, unrecognised variation in the experience of RS patients compared to CLS or OS may go unresolved. Patient experience and satisfaction with treatment are increasingly seen as important outcome measures [10], and this is reflected in recent research. In a survey of over 6000 hysterectomy patients, RS was the only independent predictor of better patient experience [11], and a survey of 140 patients undergoing robotic gynaecological surgery reported 90% satisfaction with the overall experience [12].

Qualitative methodology has been used to investigate experiences of colorectal surgery, providing insight into patients' subjective experience of surgical care [13-15] but has been less widely used in the context of robotic colorectal surgery [16]. We used thematic analysis of semi-structured patient interviews to investigate perceptions of RS, OS and CLS among patients; and to determine salient factors affecting patients' perioperative experience.

Materials and Methods

We performed thematic analysis of semi-structured interviews with patients undergoing robotic, conventional laparoscopic and open left sided bowel resection.

Participants

The study included 27 patients undergoing elective resection of left sided colorectal cancer, at Norfolk and Norwich University Hospitals NHS Foundation Trust, a large teaching hospital in the UK, between November 2020 and July 2021.

Exclusion criteria were: age below 18 years; patients who lack capacity to consent; locally advanced or recurrent rectal cancers; inflammatory bowel disease; resections with flap reconstruction; and patients who do not understand English. All patients provided written consent to their participation in the study.

Patients were approached for inclusion in the study from October 2020. Inclusion of 25-30 participants was aimed for to obtain rich data, and purposive sampling was used to ensure a roughly equal proportion of patients who underwent RS, CLS and OS. Patient recruitment and interviews continued until this target was reached. Participants' operations took place from November 2020 to July 2021. Interviews took place from January 2021 to September 2021.

89 patients were identified for inclusion over the study period and a consent form was sent pre-operatively to each. Three patients declined to give consent; no response was received from four patients. The 82 remaining patients were telephoned six weeks postoperatively to gain verbal consent, and 27 agreed to continue to interview. These patients were sent a further written consent form to return, along with a study information sheet.

As per standard practice in our institution, following colorectal cancer diagnosis and multi-disciplinary decision for surgery, patients were allocated to a particular surgeon taking account of the surgeon's skill set and logistical considerations. All surgeons were trained and experienced in the surgical technique they performed. Data analysis only took place after all interviews were completed.

Data Collection

Participants took part in an interview at least 6 weeks postoperatively. Interviews were conducted by a research nurse trained and experienced in qualitative methodology (JM). A semi-structured interview schedule (Table 1) was developed by two qualitative researchers (JM, GT) to investigate the key areas of enquiry including understanding of surgical techniques, experience of surgery and recovery, and attitude towards the surgeon.

The semi-structured interviews took the form of eight broadly-worded questions (e.g. “Tell me about...”, “What stood out...”), based on different components of the research question, to allow participants to make their own interpretations without being ‘led’ by the interviewer. Participants were encouraged to talk around the theme, rather than answering questions which assume the importance of certain issues and invite answers in a prescribed format (e.g. “How did you rate your level of pain from 1 to 10?”). In this way under-recognised themes can be uncovered and explored.

Patients were shown images of RS, CLS and OS, being performed during their interview. This was to encourage patients to engage with and react to the techniques in practice, especially to the ones the patient had not themselves undergone, rather than to a potentially abstract preconception of the technique. Interviews were audio recorded without patient identifiable data. The interviewer took notes during the interview, and wrote a reflection shortly after the interview to document first impressions.

Analysis

Audio recordings were transcribed by the interviewer. The transcription and contemporaneous notes were analysed using Braun and Clarke’s six step method of inductive thematic analysis [17]. Coding was performed by hand. The first three interviews were coded by two qualitative researchers (JM, GT), with analyst triangulation being employed to refine coding schemes and ensure reliability and credibility of emerging themes. Subsequent interviews were coded by a single researcher. The qualitative methodology we employed has been shown to provide useful information and highlight themes which may be under-appreciated using quantitative methods [18].

Results

Twenty-seven patients were recruited to the study; RS n=9 (median age 69, range 60-80); CLS n=10 (median age 72, range 32-82); OS n=8 (median age 71, range 60-75). Demographics are shown in Table 2. Key themes arising from semi-structured interviews, relating to perceptions of surgery and experience of surgery, were identified. Selected patient quotations illustrating these themes are shown in Tables 3 and 4.

Perceptions of surgical techniques

Perceptions of RS

Most participants in all groups were favourable towards the use of technology and robotics in colorectal surgery. Perceived benefits were that the robot's dextrous arms could allow better reach and manipulation of instruments, the surgeon's view of the operation site was better through the monitor, the technology could detect more than the human eye, and that surgery was less invasive, "So you can deal with a much smaller area. You're not having to rely on human eye...so you don't have to cut open so far and so the recovery is quicker" (participant 20, CLS).

Perceived limitations of robotics related to potential technological failings which may cause harm, "I always think well there's always something that can go wrong with a machine...if suddenly something goes wrong and the knife goes too deep or it goes the wrong way" (participant 30, OS). Reliance on technology that might go wrong was viewed as an acceptable risk for some but caused apprehension for others. Testing of new surgical interventions in controlled trials prior to being used in routine practice increased some patients' confidence, "I would have trust in the surgical trials and the testing that they would have to go through" (participant 9, CLS).

Perceptions of OS

OS was perceived by some as superior to RS or CLS. Participants attributed this to better visualisation of the surgical field with OS, "It's quick and easy and he got the problem out and he could see what he was cutting away" (participant 29, OS); and the reliability afforded by the perceived greater skill of the surgeon with OS, "You could actually draw on the surgeon's experience perhaps in his operating, during the operating, to see if there was any, any other suspicious items" (participant 26, CLS).

However, the majority suggested OS is more invasive, less refined, involving bigger incisions and with greater risk of wound infection and pain, resulting in a longer recovery time, "they were able to remove [the cancer] fairly well and quickly but the problem that I found was the wound. It took longer to heal and being able to become mobile was longer" (participant 34, OS).

Perceptions of CLS

Participants compared CLS with OS and RS. Participants understood benefits of CLS compared to OS, such as less tissue damage, smaller incisions, less pain and infection and a quicker recovery time, "There's much less chance of infection because you've got much smaller things going in... much smaller holes, as in smaller incisions needed, because you've got again smaller things, tools going in" (participant 20, CLS).

Potential disadvantages of CLS compared to OS were limited visualisation of the surgical field given by the monitor, and concern that laparoscopic instruments may be difficult for the surgeon to use, especially when dealing with an intra-operative complication, “There might be a higher bleeding risk if you didn’t see a bleeder that you would have seen with an open approach” (participant 6, OS).

Comparing CLS to RS, participants were reassured that their surgeon was directly manipulating the laparoscopic instruments instead of a machine, “from an engineering point of view, I felt more comfortable with the fact that it was done manually with the skill of the surgeon rather than perhaps trying to do it through a TV screen” (participant 35, CLS).

Experience of Surgery

Themes which varied by surgical technique were postoperative pain and wound size.

Postoperative pain

Experiences of and ability to cope with pain were mentioned by patients across all groups, although with variation in severity. Participants in the open group reported that their pain was prolonged and at a significantly higher level than they had expected, “the pain overtook me and I couldn’t get out of bed without crying or struggling with the pain” (participant 73, OS). CLS and RS participants generally described lower levels of pain than expected and for shorter duration, “I mean there was surprisingly little pain I had to endure really afterwards. Maybe the painkillers were very effective...it all seemed to be quite, you know, quite good” (participant 26, CLS). “I couldn’t understand when I came round from the surgery, I didn’t have no [pain]” (participant 4, RS). Where CLS participants reported pain, it was mostly associated with secondary sources such as wound infection, “[with wound infection] the pain scores up until then, I was in the one and two bracket and then all of a sudden I went into the four bracket”, (participant 33, CLS).

Wound size

In general, RS and CLS participants were less concerned with the size of wounds than OS participants, “I say the wounds that the incisions were small. Healed fairly quickly” (participant 33, CLS). OS patients in particular reported emotional impact from larger than expected surgical wounds, “I was quite shocked when I saw the size of the scar” (participant 73, OS). However, unexpected bodily change was also an issue for some CLS and RS participants, “having talked about robotic surgery and having no idea what that would involve, you have your shower the next day and ‘oh my goodness’ because at the time you’ve got bruising and you’ve got all the purple glue all over” (participant 28, RS).

Themes described similarly by all participants were wound issues/infection, other postoperative complications, ward environment, emotional impact of surgery, and importance of communication with the surgeon. Some participants highlighted the mismatch between expectations of recovery and the reality of what they experienced.

Wound issues/infection

Participants in all groups experienced post-operative wound infection, the consequences of which varied from a six-day readmission to hospital for intravenous antibiotics, to twice weekly dressing changes, “I was going back twice weekly to the doctors to get that re-dressed ... now they’re healed, two months’ later” (participant 20, CLS). For one participant a prolonged wound infection resulted in being unable to start adjuvant chemotherapy.

Other postoperative complications

Postoperative complications which prolonged hospital stay and impacted on their experience of recovery were reported by patients in all groups. The most significant was postoperative ileus, which was discussed predominantly by the robotic and open group participants, “I had a nasogastric tube put down... I lost two and a half stone in ten days” (participant 6, OS). Participants also reported delirium and PR bleeding, which they experienced as significant events in their post-operative recovery, “I passed a lot of blood you know, sort of wind and a lot of blood for a couple of the nights... a bit uncomfortable. Well a bit embarrassing really cos when it goes through the bed or you’ve been on the sheets you think, oh dear” (participant 16, CLS).

Ward environment

Participants in all groups described experiences of the relationship with nursing staff and the physical ward environment. Some patients were distressed by breakdown of communication with ward staff, “I was, I was bit nervous and concerned about [discharge], to be honest. I felt I wasn’t ready and I tried to make my point that I didn’t feel comfortable with doing that... Anyway I made my point. He made his point” (participant 35, CLS). Key aspects of the physical ward environment identified as influencing postoperative recovery were accessibility of toilet facilities and sleep disturbance, “when you feel that you have to go, you couldn’t say ‘well I’ll wait ten minutes’ because you couldn’t wait ten minutes” (participant 8, RS), “what upset me most when I was in hospital was the amount of times I was woken up during the night ... it seemed interminable” (participant 17, CLS).

Emotional impact of surgery

The emotional impact of surgery stemmed from bodily change, shock of diagnosis, and the short time-frame before surgery. OS patients in particular described emotional impact from larger than expected surgical wounds, "I was quite shocked when I saw the size of the scar" (participant 73, OS). However, patients in all groups discussed the emotional impact of surgery in the post-operative period, "I'm looking at three months, not lifting anything heavy, not being able to do any gardening or too much housework. I find that very frustrating and quite depressing in a way. Mentally, I feel it's held me back from getting on with my life", (participant 73, OS), "I looked at myself and thought my god you know, I just didn't feel comfortable at all" (participant 3, RS). Two participants reflected that they were not warned of the emotional impact preoperatively and highlighted the need for greater awareness among healthcare professionals.

Importance of communication with surgeon

Communication with their surgeon was important for all participants in their experience of surgery. Time invested by the surgeon in participants' preoperative preparation, by listening to concerns and providing clear explanations with time to answer questions, was especially valued, "he was very open, honest and practical. He gained my trust very quickly" (participant 9, CLS). The surgeon's professionalism, expertise and experience increased patients' confidence and trust, "I could tell that he was very passionate and very experienced in what he was doing so that really gave me a lot of confidence and a lot of faith in him" (participant 3, RS).

Discussion

Qualitative methods have previously been used to investigate RS patients' perceptions and experiences [19, 20] but our study is one of the few in which RS, CLS and OS have been compared.

Most patients had a positive view of innovation in surgery and an appreciation for the technological benefits afforded by RS, but were concerned by the possibility of technological issues causing harm, and perceived there to be less direct involvement of the surgeon. Patients understood the benefits of CLS, but perceived the technique to be more difficult for the surgeon to perform compared to OS. It is important that healthcare providers consider, and if necessary address, these concerns during preoperative discussions with colorectal patients.

Pain and wound size were significant themes for all patients, but were experienced differently. RS patients reported generally lower than expected levels of pain and smaller than expected wounds. This was shared with CLS patients, but not with most OS patients who experienced distress from pain and wound size. Participants in all groups reported negative aspects of the postoperative recovery for which they felt poorly prepared, including physical issues such as wound infections, postoperative complications including ileus, issues with the ward environment, and emotional stress. However, participants' overall experience was improved through preoperative discussion with the

surgeon. These results illustrate the importance patients attribute to pain and wound size, and re-affirm the potential benefits of minimally invasive surgery (MIS) in these areas.

CLS has become increasingly employed over recent years [20], and is now ubiquitous in colorectal practice [21]. Perceptions of CLS as compared with OS were generally positive in all groups, and emphasised the postoperative benefits of MIS. This aligns with proven short-term surgical benefits of CLS over OS, including less blood loss, shorter bowel recovery time, and smaller incision [22]. Concerns mostly related to the perceived intraoperative technical and ergonomic difficulties of CLS compared with OS, for example limited visualisation and instrument control, and implications for safety if difficulties are encountered intra-operatively. Laparoscopic colorectal surgery can present a substantial learning curve to surgeons unfamiliar with the approach [23], and there is a recognised risk of CLS-specific technical error [24]. It is likely that any patient apprehension of CLS can be lessened by explanation of its technical aspects and safety.

Participants perceived OS as being more invasive than MIS resulting in longer recovery and more post-operative pain. This perception is partially borne out by two trials [22, 25], which have demonstrated higher blood loss and larger incision in OS compared to CLS, although in neither did this correspond to increased length of hospital stay or analgesia use. However, some participants considered OS a safer method owing to better visualisation and a perceived greater ability of the surgeon to employ physical skill, compared with CLS or RS. Similarly, some patients' perception of CLS as more reliable than RS can be similarly attributed to the trust the patient places in the surgeon as the person 'directly' performing the procedure.

Significantly, participants in all groups generally responded positively to the concept of RS, associating it with more technical finesse and an enhanced ability for the surgeon to detect intra-operative problems. Similar findings have been demonstrated previously: Ahmed et al. [9] investigated perceptions of RS among patients and healthcare providers through face-to-face surveys. RS was viewed by as lowering wound infection rate, blood loss, incision size, and complication rate compared to CLS. Apprehension centred on the fear of technological failure causing intraoperative damage. Similarly, a large survey [7] of 745 individuals revealed that whilst most believed RS to offer better results compared to CLS, 20% thought the robot had a degree of autonomy during surgery, and most would prefer to have CLS. Similarly, McDermott et al [8] found that misconceptions about the roles of the robot and surgeon among robotic hysterectomy and prostatectomy patients translated to concerns about safety. Patient apprehension about RS is a recognised phenomenon [26]. Preoperative discussion with the surgeon and explanation of RS, including its risks, could bridge patients' ideas about the benefit of RS with the personal trust placed in the surgeon.

National UK audit data [27] shows 72% of colorectal cancer operations in the UK are performed with an initial laparoscopic approach, and 28% with an open approach, although there is geographical variation. In 2019 RS was only performed by 102 individual surgeons across 30 hospital trusts.

Participants in our study accepted the potential advances of CLS and RS, providing impetus towards further widening provision of MIS.

Postoperative recovery was a significant factor in the experience of surgical care in all participants. In contrast to patients' understanding of their surgery itself, many felt poorly prepared for the physical and emotional burden of recovery. Pain, wound infections and ileus were emphasised. Our findings are reinforced by Cuijpers [14] et al's qualitative study which also identified lack of preparedness for postoperative complications including ileus, as significant factors affecting colorectal patients' experience of recovery. Postoperative ileus, characterised by delayed gastro-intestinal recovery after surgery, affects 12% of elective colon resection patients [28]. Our findings suggest patients are not properly informed about the consequences of this common but potentially devastating complication, which can require nasogastric tube insertion, parenteral feeding and prolonged hospital stay [29].

Emotional impact was also significant for participants, who cited physical changes and symptoms, and the short period between diagnosis and surgery as causes. Qualitative studies have been used to investigate similar themes. Abelson [13] et al analysed causes of distress by colorectal surgery patients. Disruptive ward environments, physical symptoms and postoperative complications were key causes identified, and the authors highlighted the mismatch between patients' experiences and their expectations during recovery. Wang [15] et al also identified poor emotional health as a significant factor in the preoperative period. It is recognised that patients can have unrealistic expectations for the postoperative period, such as short recovery time after major colorectal procedure [30]. Accurate pre-operative counselling is essential to ensure full patient engagement in their recovery goals [31]. Our findings reaffirm the importance of preoperative patient education.

This study has limitations. Although our sample size of 27 participants was sufficient to obtain rich data, its relatively small size means findings may be distorted by the over- or under- representation of patient groups. In particular two thirds of those interviewed were male, corresponding to the demographic breakdown of patients eligible for inclusion, and therefore issues particularly affecting female patients may be overlooked. Moreover, as the researcher conducting the interviews was female, it may also be the case that male patients were less keen to discuss sensitive or emotional issues. There also exists the possibility of self-selection bias, as patients who have had a positive experience of surgery, of any technique, may be more likely to agree to participate in healthcare research. This may mean some important negative experiences are not picked up on in our study.

Conclusions

Our qualitative study provides insight into patients' perceptions of RS, OS and CLS; and patients' experience of left-sided bowel resection by these techniques. Patients understand the benefits of technology in surgery, and of MIS generally, but remained concerned about technological failure and a perceived lack of direct surgeon involvement. Surgeons should be aware of these perceptions and potential need to address them during consultations with patients. Significant themes in periop-

erative experience included pain and wound size, with RS and CLS patients describing less pain and smaller wounds than expected. For patients in all groups, wound and other post-operative complications, the ward environment, emotional impact and communication with the surgeon were important issues affecting their peri-operative experience. Preoperative discussion of the technical aspects of the surgery and the post-operative course is essential so patients' expectations of colorectal surgery match reality.

Statements and Declarations

Ethical approval

This study received ethical approval in our institution (Norfolk & Norwich University Hospital NHS Foundation Trust).

Consent to participate

All patients provided written consent to their participation in the study.

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Conflicts of interest

The authors declare that they have no conflict of interest.

Authors' contribution statements

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Jane McCulloch and Gabrielle C Thorpe. The first draft of the manuscript was written by Oliver Claydon and revisions were made by Oliver Claydon. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author [OC]. The data are not publicly available due to them containing information that could compromise research participant privacy.

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Table 1 Interview Schedule

1	Please can you start by telling me about your experience of having surgery? <i>Note down all key areas mentioned and probe for further explanation of each</i>
2	What stood out for you as significant in your recovery? Why was this? <i>Probe for positive and negatives, examples, further explanation</i>
3	You have had (open/laparoscopic/robotic) surgery. What is your understanding of that approach to surgery?
4	<i>Researcher to display pictures of the surgeon operating on a patient using the three approaches. The pictures will clearly show the position of the surgeon and any equipment being used but will avoid showing anything that might upset them such as an open abdomen</i> For each What do you think might be the benefits for the patient of this approach to surgery? What problems might the patient experience with this approach?
5	There are a lot of new technologies being developed in surgery, such as robotics and artificial intelligence. What do you think about these sorts of developments?
6	What characteristics or qualities do you value in your surgeon?
7	Are there any other qualities that you would look for if your surgeon was using these new technologies?
8	Is there anything that we have not talked about that you think is important to consider when thinking about the kind of surgery you have had?

Table 2 Participant demographics

	Number of participants				Median participant age (range)
	Total	Male	Female	Stoma formed	
Robotic Group	9	5	4	2	69 (60-80)
Conventional Laparoscopic Group	10	8	2	1	72 (32-82)
Open Group	8	5	3	7	71 (60-75)

Table 3 Quotations illustrating themes of patients’ perceptions of RS, OS and CLS

Perceptions of robotic surgery	
Benefits of technology	<p>Robotic surgery patients</p> <p><i>“They’re so precise and they can, they can see things and detect things that perhaps somebody standing there [cannot]”</i></p> <p><i>“I’ve seen these things sort of peel a grape and stuff like that and then stitch them back up again”</i></p> <p><i>“So it looks as if it’s very precise and very accurate”</i></p>
	<p>Open surgery patients</p> <p><i>“Less handling of the internal organs, the bowel, the skin... and less likely to get nerve damage”</i></p> <p><i>“[the surgeons] can sit there on their laptops and control the robot so that there isn’t so many people in attendance”</i></p> <p><i>“They’re so more accurate, so they can pinpoint a place where they’ve got to get to”</i></p>
	<p>Conventional laparoscopic surgery patients</p> <p><i>“I’m assuming it’s still more precision...in theory the best technical care because umm the knife will sit in the right place I suppose”</i></p> <p><i>“I am told that the precision of the robotic surgery is normally very good and...I think it is semi-automatic, on looking at or fully automatic”</i></p>
Technological failure	<p>Robotic surgery patients</p> <p><i>“Some of these automated...there’s always something that can go wrong, I suppose, like a car or anything else”</i></p> <p><i>“You are reliant on things that maybe could go wrong...as in you might have a malfunction of equipment”</i></p>
	<p>Open surgery patients</p> <p><i>“you are relying on the surgeon being very adept with the controls and the computer doing exactly what the surgeon tells it to do. We all know computers can occasionally get things wrong”</i></p> <p><i>“I don’t know whether the naked eye would see better or whether the cameras”</i></p>

	<p>Conventional laparoscopic surgery patients</p> <p><i>"You know, it's not the surgeon making the cut is it. It's the surgeon directing a machine to do it... You feel a bit more detached and nervous"</i></p> <p><i>"The action of the machinery might be, you know like a person can be quite gentle...whereas a machine could be a bit abrupt...and may do some other damage"</i></p> <p><i>"I suppose umm it's all a bit remote...it feels a bit new and you're not trusting the surgeon to do it cos it all machine, it's all done by machine"</i></p>
Perceptions of open surgery	
Better visualisation	<p>Robotic surgery patients</p> <p><i>"I have heard people saying that, you know, if they get the open surgery, they're surer that they get it all"</i></p>
	<p>Open surgery patients</p> <p><i>"I don't know how much the surgeons can see when they are doing a robotic...direct vision is the answer"</i></p>
	<p>Conventional laparoscopic surgery patients</p> <p><i>"I suppose it's from the prospective of getting you to the bits you need to see, and cut exactly or whatever you, you know can see it more clearly"</i></p> <p><i>"Well they can see exactly what they are doing and where they've got to cut"</i></p> <p><i>"they could see through the naked eye, is clear really...it would certainly be easier with open surgery"</i></p>
Surgeon's technical skill improves reliability	<p>Robotic surgery patients</p> <p><i>"In comparison [to robotic], it's tried and tested surgery and must have been done that way for a long time"</i></p>
	<p>Open surgery patients</p> <p><i>"A pair of hands in there working on you are better than a machine"</i></p> <p><i>"When they've got their hands, you know when they do like use their hands...They can pick your stomach tube up...And perhaps feel"</i></p>
	<p>Conventional laparoscopic surgery patients</p> <p><i>"You could actually draw on the surgeon's experience perhaps in his operating, during the operating, to see if there was any, any other suspicious items"</i></p> <p><i>"If there's quite a lot of open wounds they will be more intricate"</i></p> <p><i>"The surgeon has his hands on the tools as it were so that he can see...exactly what is going on"</i></p>
More invasive, and longer recovery	<p>Robotic surgery patients</p> <p><i>"Personally I can't see any benefits, because it's more invasive than actually cutting and going in"</i></p>
	<p>Open surgery patients</p> <p><i>"You've got umm a retractor going in, which I think creates significant pressure on the skin edges"</i></p> <p><i>"It takes longer to heal...and I would say maybe a lot more blood...plus the recovery would be a lot longer... you would have to have a follow-up to have the stitches or staples removed"</i></p>

	<p>Conventional laparoscopic surgery patients</p> <p><i>“The scar will be bigger, so the healing will be harder ...[and may get] infections”</i></p> <p><i>“Obviously the recovery would be quite major...and I don’t know if there is a bigger risk of bleeding or not healing”</i></p> <p><i>“The down side of it is that, a wound that’s size always takes ages to heal, doesn’t it?”</i></p> <p><i>“It’s like more intrusive like... it just will take a lot longer to heal on the stomach than keyhole surgery because it would have been a small incision”</i></p>
Perceptions of conventional laparoscopic surgery	
Smaller incision and quicker recovery compared with OS	<p>Robotic surgery patients</p> <p><i>“You’re not going to have that big abdominal incision probably”</i></p> <p><i>“I would imagine that again that’s they’re smaller incisions...Which are gonna heal quicker”</i></p>
	<p>Open surgery patients</p> <p><i>“Less invasive...there’s no retractors in the skin edge. There is less of a scar to get infected or to get sore”</i></p> <p><i>“You wouldn’t have all the scarring... I presume with that he wouldn’t have the muscles having to be re, you know, regenerating their cells again... And everything heals up twice as quick”</i></p> <p><i>“It wouldn’t be so intrusive... like you know you would only have a smaller scar”</i></p>
	<p>Conventional laparoscopic surgery patients</p> <p><i>“There’s a lot less opportunity of getting post-operation infection”</i></p> <p><i>“Time to recovery generally better when it’s this kind of surgery as opposed to not just a straightforward open surgery”</i></p>
More technically challenging compared with OS	<p>Robotic surgery patients</p> <p><i>“The tools look slightly more awkward to use, slightly more difficult to use”</i></p>
	<p>Open surgery patients</p> <p><i>“Something could be missed as you’re not looking at the whole area as you are with open surgery”</i></p> <p><i>“It takes longer and it’s more fiddly to...they have to be more careful”</i></p>
	<p>Conventional laparoscopic surgery patients</p> <p><i>“I can only, only assume it’s quite fiddly so you’ve got to get it exactly right.... I don’t know whether there’s more, it’s more of a challenge for the surgeon”</i></p> <p><i>“I kept imaging how you would do it keyhole and thinking, it must be really fiddly”</i></p> <p><i>“I could see [open surgery] would be easier if there is a complication”</i></p>
Surgeon performing procedure more directly compared with RS	<p>Robotic surgery patients</p> <p><i>“It’s more hands on. They are actually guiding things, they are not like moving the...joystick or what they use to move the machine. They are actually hands on moving the cutters and everything else they use inside you”</i></p> <p><i>“[surgeon’s view is] better there, than the robotic one...when he moves, he knows exactly where he’s moving to”</i></p>

Open surgery patients
<i>"I can see he is actually standing there with the patient and what I see is absolute concentration from the surgeon"</i>
Conventional laparoscopic surgery patients
<i>"It's thorough...the surgeon has his hands on the tools as it were so that he can see exactly what is going on"</i>

Table 4 Quotations illustrating themes of patients' experiences

Variation in themes with surgical technique	
Post-operative pain	<p>Robotic surgery patients</p> <p><i>"I've been very lucky. I would say it was quite tender but, no not painful. I've never taken painkillers. It's all been amazing"</i></p> <p><i>"I rang up and said I've got some pain with, with this belly button thing"</i></p> <p><i>"I wasn't in a great a lot amount of pain I must admit. I was for like the first afternoon and then the next day but after, no it was fine"</i></p>
	<p>Open surgery patients</p> <p><i>"I was quite shocked when I saw the size of the scar and it was incredibly painful and it took a while obviously for the stitches to dissolve"</i></p> <p><i>"The pain was just horrendous until the morphine arrived"</i></p> <p><i>"I wasn't in pain or anything"</i></p>
	<p>Conventional laparoscopic surgery patients</p> <p><i>"From a pain point of view, none at all...that seemed to be well-controlled. I was then, after that in terms of pain put on, just on tablets"</i></p> <p><i>"I really can't now remember much about how much pain I felt when I had the operation. I don't think it was too much"</i></p>
Wound size	<p>Robotic surgery patients</p> <p><i>"I just can't believe it. Cos it's healed up so quickly... they've all gone now"</i></p>

	<p><i>"They've healed so, well they're just like little pink thin lines"</i></p> <p><i>"I was a bit sort of inquisitive and I meant to ask is why I've got like mini scars"</i></p>
	<p>Open surgery patients</p> <p><i>"It looked like I had just come out of a butcher's"</i></p> <p><i>"I was expecting such a big scar but then again like I suppose you've got to get your hand in there, haven't they?... I only thought it would be about 4-5 inches but obviously like, they have to open you up more to get to your stomach more"</i></p> <p>Conventional laparoscopic surgery patients</p> <p><i>"The little, the little holes healed up very quickly and I felt no bother"</i></p> <p><i>"There were just three or 4, maybe 4 incisions in the end, two small ones and one larger one...which healed nice. In fact two of them have virtually disappeared"</i></p> <p><i>"Well you know, I mean one of the side wounds was quite big, about 4 inches long ...but the others were so tiny that umm yeah after the first couple of days they didn't hurt at all"</i></p>
Common themes	
Wound issues	<p>Robotic surgery patients</p> <p><i>"I have suffered a little bit with the extraction scar...I've got a bit of an infection"</i></p> <p><i>"And I came out without, out knowing perhaps what to expect; for instance when I was worried when the wound was leaking...or weeping"</i></p> <p>Open surgery patients</p> <p><i>"I took [the dressings] off, and all of a sudden one of them starting leaking again...And there was, more than a better word, poison coming out"</i></p> <p><i>"They were able to remove [the cancer] fairly well and quickly but the problem that I found was the wound. It took longer to heal and being able to become mobile was longer"</i></p> <p>Conventional laparoscopic surgery patients</p> <p><i>"[The wound] started leaking again. Went back in, did a swab. It was infected this time. So I then had another three weeks of antibiotics and re-dressings"</i></p> <p><i>"There was an issue with a slight leakage...which caused a higher temperature"</i></p> <p><i>"The district nurse came out and it was swollen and she was probing it and she said she could feel a lump and she thought it wise to start on antibiotics"</i></p>
Post-operative complications	<p>Robotic surgery patients</p> <p><i>"Ileus so I was really sick. I couldn't keep any food down so I didn't eat for days. In the end I had to have a nasogastric tube down into my stomach...which was very unpleasant"</i></p> <p><i>"But then at some time through the night I was very sick...vomited quite a lot...I was on the drip and then they tried to pass a nasogastric tube"</i></p> <p><i>"I ended up with a bag down my throat...Into the stomach"</i></p> <p>Open surgery patients</p> <p><i>"This bag wouldn't work so I had pipes going down my nose and down there...I just thought what the hell's happened to me"</i></p> <p><i>"I expected to feel sore but was not expecting to feel as devastated as I was. I got an ileus and I had a nasogastric tube put down"</i></p>

	<p>Conventional laparoscopic surgery patients</p> <p><i>“My legs became huge, like tree trunks. My arms were so heavy I could hardly lift them so I had a huge water retention problem”</i></p> <p><i>“I had what they said was post-op delirium... I kicked off with this delirium thinking that patients in the room were going to actually kill me. I was absolutely terrified”</i></p> <p><i>“I hadn’t been successful in going to the loo. I was bleeding actually and that is a bit disconcerting... passing some blood. Some blood came out”</i></p>
<p>Importance of ward environment</p>	<p>Robotic surgery patients</p> <p><i>“When you feel that you have to go, you couldn’t say ‘well I’ll wait ten minutes’ because you couldn’t wait ten minutes. It was a case of ‘I need to go now’”</i></p> <p><i>“It’d leaked everywhere and umm I did ring the bell and they came and she said ‘right, we’ll get somebody with you in a minute’. And, you know, then I timed it - it was over an hour. I had to ring again”</i></p> <p>Open surgery patients</p> <p><i>“Well I sort, I sort of struggled and...And trying to go to the toilet and things like that and there was no help there, and you walk out to the toilet, just about managing”</i></p> <p><i>“It seems as though you were left to your own means in the night times, and it wasn’t very good... trying to go to the toilet and there was no help there”</i></p> <p><i>“I just couldn’t get much sleep in there at all ... it was just too hot in there”</i></p> <p>Conventional laparoscopic surgery patients</p> <p><i>“It’s just the language used isn’t it and the way you kind of approach things... What a difference it makes really. The little comments and things”</i></p> <p><i>“There had been times, you know, couldn’t sleep when I wanted to”</i></p>
<p>Emotional Impact of surgery</p>	<p>Robotic surgery patients</p> <p><i>“I got really down...and I’m saying ‘I’m not getting better’ ...I think it’s gonna affect me for some time... sometimes I’d cry”</i></p> <p><i>“I had such a quick diagnosis and I was in hospital so fast, like within, I think it was within three weeks and I think that has an effect on you mentally, that you don’t expect”</i></p> <p>Open surgery patients</p> <p><i>“I think there is a lot to be said for how mentally you are able to cope with it, not only physically but mentally as well”</i></p> <p><i>“I was not expecting to have such a down moment after surgery”</i></p> <p>Conventional laparoscopic surgery patients</p> <p><i>“I am a very, very anxious person. I have been suffering with anxiety the whole of my life. I found it really hard”</i></p> <p><i>“And to your mind, because, because that’s a huge knock-on effect. I found, I found that, that it can affect your mental health so much”</i></p>
<p>Importance of communication with surgeon</p>	<p>Robotic surgery patients</p> <p><i>“That does help you mentally when you meet someone and you’ve got confidence in what they’re gonna do”</i></p> <p><i>“And then I saw two or three other surgeons just drop into see how I was, but they were all really, really good and really informative”</i></p>

Open surgery patients

"I felt that post-operative it was a fairly brisk affair err both from the surgeons and the anaesthetist"

"I got a drawing of what was going to be taken out. It was helpful and it explained it to the wife, as I could bring it home and she got the idea of how deep he went into it"

Conventional laparoscopic surgery patients

"I had some very good preparatory conversation with [the surgeon] ...Such confidence, being able to meet the surgeon face-to-face and also just to get such clarity from him"

"He gained my trust very quickly, and he listened to everything that I had to say and never looked like he was disinterested, or running short of time. He just had time to listen to what I was talking about and that meant loads, actually"