ORIGINAL ARTICLE

Experience of wrong site surgery and surgical marking practices among clinicians in the UK

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Background: Little is known about the incidence of ''wrong site surgery'', but the consequences of this type of medical error can be severe. Guidance from both the USA and more recently the UK has highlighted the importance of preventing error by marking patients before surgery.
Objective: To investigate the experiences of wrong site surgery and current marking practices among clinicians in the UK before the release of a national Correct Site Surgery Alert.
Methods: 38 telephone or face-to-face interviews were conducted with consultant surgeons in ophthalmology, orthopaedics and urology in 14 National Health Service hospitals in the UK. The interviews were coded and analysed thematically using the software package QSR Nud*ist 6.
Results: Most surgeons had experience of wrong site surgery, but there was no clear pattern of underlying causes. Marking practices varied considerably. Surgeons were divided on the value of marking and varied in their practices. Orthopaedic surgeons reported that they marked before surgery; however, some urologists and ophthalmologists reported that they did not. There seemed to be no formal hospital policies in place specifically relating to wrong site surgery, and there were problems associated with implementing a system of marking in some cases. The methods used to mark patients also varied. Some surgeons believed that marking was a limited method of preventing wrong site surgery and may even increase the risk of wrong site surgery.
Conclusion: Marking practices are variable and marking is not always used. Introducing standard guidance on marking may reduce the overall risk of wrong site surgery, especially as clinicians work at different hospital sites. However, the more specific needs of people and specialties must also be considered.

Studies investigating the incidence of adverse events in hospitals have found that unintended patient harm is associated with around 3–17% of hospital admissions.[1–5] It is estimated that medical error costs the US government in the range of $29 billion annually and that per year up to 98 000 preventable deaths occur as a result of medical error.[6] In the UK, adverse events may cost approximately £2 billion a year in additional hospital stays alone.[7] This has led to policy initiatives to reduce risk and promote quality.[8]

One serious medical error is ''wrong site surgery'', which is perhaps one of the least common, but potentially most catastrophic errors in medicine. Wrong site surgery refers to surgery on the wrong side of the patient or on the wrong anatomical location or level. It also includes carrying out a procedure on the wrong patient or carrying out the wrong procedure on the correct patient.[9] To date, little is known about the incidence of wrong site surgery, as current data rely mainly on the willingness of healthcare professionals to report such events voluntarily.[10] Most of the work relating to wrong site surgery comes from the USA, where data from 22 medical malpractice insurers suggested that there were 225 claims for orthopaedic wrong site surgery and 106 from other surgical specialties.[11] Moreover, the Joint Commission on Accreditation of Health Care Organisations sentinel event database[12] contained 150 reported cases of wrong site surgery between 1998 and 2001, most of which came from orthopaedics. The Joint Commission on Accreditation of Health Care Organisations has issued guidance on preventing wrong site surgery, which places a strong emphasis on marking surgical sites before surgery and on using a verification checklist.[11]

In the UK, a study by the National Patient Safety Agency (NPSA) found ambiguity and uncertainty among hospital staff relating to routine policies for preventing wrong site surgery, particularly marking,[13] and, as a result, issued guidance on how to prevent wrong site surgery, in the form of an alert that was sent to all hospitals in the UK.[14] This paper reports the results of a study that aimed to establish the marking practices followed by clinicians immediately before the NPSA Correct Site Surgery Alert in early 2005. It also provides baseline data against which the effect of the NPSA Correct Site Surgery Alert can be assessed.

METHODS

A questionnaire was designed to be answered face to face or by telephone interview to gather both quantitative and qualitative data on surgical marking practices among clinicians in the UK. The questionnaire was divided into five main sections:

- Experience of wrong site surgery
- General systems in place to reduce wrong site surgery
- Marking for wrong site surgery
- Other methods of identifying the correct site for a procedure
- Views about the potential value of a national system for minimising wrong site surgery

Abbreviations: NHS, National Health Service; NPSA, National Patient Safety Agency

The sections were chosen to deal with the main objectives of the study and to collect baseline data as part of the before–after evaluation. The questions were informed by the literature, a review of guidelines on measures to avoid wrong site surgery issued in the USA and a draft copy of the Correct Site Surgery Alert later issued in England and Wales. The questionnaire contained questions relating to hospital or specialty marking policies, whether marking was commonplace, attitudes towards marking, methods of marking and the personnel involved.

A purposive sample was selected. The interviews were conducted in the specialties of urology, ophthalmology and orthopaedics at 14 National Health Service (NHS) hospitals in the UK. The hospitals were selected in the following way: five randomly selected hospitals, five hospitals that were part of an existing clinical epidemiology network (for ease of access) and four hospitals that were part of the Safer Patients Initiative[15] (with a view to finding possible exemplar sites). The specialties were selected because laterality is a frequent issue in their operations. The questionnaire was piloted with five potential participants to identify any problems with the questions and any potential gaps in the information required, and was revised accordingly.

Before each interview, each participant was given a definition of wrong site surgery. All interviews were tape recorded with the permission of participants. The qualitative data were transcribed and downloaded into QSR Nud*ist 6 for coding. Six transcripts were coded independently by the three researchers who conducted the interviews and, from this exercise, a coding frame was developed, which was then applied to each of the transcripts. Emergent themes and subthemes were discussed in the team.[16] The main themes grouped under the general heading of ''marking'' were experience of wrong site surgery; factors associated with wrong site surgery; hospital or specialty marking procedures; variations in marking behaviour by specialty; methods of marking; concerns about marking; and who does the marking. Each of these is discussed here.

RESULTS

Participants

Semistructured telephone or face-to-face interviews were conducted between December 2004 and February 2005 (table 1).

Experience of wrong site surgery

Participants were asked to recall instances of wrong site surgery or near misses of which they themselves had personal knowledge. Many offered accounts of past experiences and the possible factors associated with wrong site surgery. The factors associated with wrong site surgery were highly varied (table 2).

Failure to mark, as in the following instance, was rarely mentioned.

> I was involved as a junior with my consultant when he started doing an arthroscopy of the knee on the wrong side. We'd had a busy night; it was a rushed ward round in the morning and the patient hadn't been marked and, people had misread. We had a list of arthroscopies indicating Right, Left, Right, Right, Left, you know, and, for some reason, the thing was misread, the wrong leg was prepped and the arthroscopy was started and it wasn't until then that somebody picked up that was wrong leg. (Participant 15, consultant orthopaedic surgeon, hospital 5)

Although a mark can, in most cases, identify the site, it does not identify the procedure to be performed at that site. Thus, one person described an instance where, although the surgeon had operated on the correct hand, he had chosen the wrong bone in the hand. In other instances, errors had

Table 2 Factors associated with wrong site surgery

Active	
Problems with marking	Failure to mark
	Wrong side/site marked
	Both sides marked
Problems with consent	Patient consented to wrong procedure/site/side
	Language difficulties
	Patient consented for procedure already performed or after surgery
Problems with preparation/ positioning	Preparation of wrong side/site
	Preparation for wrong procedure
	Patient wrongly draped
	Tourniquet put on wrong side
	Patient wrongly positioned
Measurement problems/ failures	Measurements wrongly recorded
	Wrong measurements taken
	Measurements misread
Anaesthetic problems/ failures	Patient anaesthetised early (before consultant has talked to patient)
	Anaesthetic given from unfamiliar position resulting in wrong side
Latent	
Wrong patient	Patient answers to wrong name
Problems with theatre lists	Wrong side/site/procedure typed on list
	Theatre list changed at last minute
Problems with notes	Missing notes, duplicate note
	Notes wrongly written up
	Transcription errors
	Correct patient but wrong notes
Problems with *x* rays	x Rays wrongly labelled
	x Rays put up wrong way round
	No *x* rays
Work pressures	Interruptions between operations
	Time pressures
	Loss of concentration
Failure of communication within hospitals	Failure of communication between staff/wards/theatre
	Failure of communication between different departments
Failure of communication between hospitals	Patient had procedure different from that promised at original hospital
	Patient seen elsewhere privately with different procedures or different equipment

Table 1 Study participants

	Urology		Ophthalmology		Orthopaedics*		Total	
	Tel	Face to face	Tel	Face to face	Tel	Face to face	Tel	Face to face
Consultants	5	8	5	8	4	8	14	24
Total	13		13		12		38	

Tel, telephone.
*One of the trusts did not have an orthopaedic department.

occurred (or nearly occurred) as a consequence of patients having been wrongly marked.

Past experience of wrong site surgery also seemed to have an effect on whether or not surgeons marked. In some cases, surgeons adopted a policy of not marking, as marking had seemed to compromise patient safety in the past, whereas in others the reverse was true.

Hospital or specialty marking procedures

Marking was occasionally included as part of the hospital consent forms, although few trusts had a trustwide procedure for marking. Where they existed, marking procedures tended to be specialty specific and even varied within specialties where different consultants used different methods of marking. In some departments individual consultants seemed to decide their own practice, and it was common for consultants to know little or nothing of what their colleagues did.

In some departments there had been discussion among colleagues about marking, but these were restricted to unwritten agreements within the specific department. For instance, one team of urologists decided that each surgeon could make his or her own decision about marking.

> I think it is wrong for someone to say, 'This is the system you will use'. … Colleagues can make their own decisions about whether they would allow the patient to be marked.
> (Participant 16, consultant urologist, hospital 6)

Sometimes the discussions led to a policy of no marking.

> Policy has been devolved down to specialties. There is no absolute policy. We have debated whether we will put little coloured stickers over the eyebrow to indicate the eye that should be done, and we decided it shouldn't be. (So we have) no marking at all. We have resisted marking.
> (Participant 18, consultant ophthalmologist, hospital 6)

Variations in marking behaviour by specialty

All but one orthopaedic surgeon said that they marked the patient's skin, but only half of the urologists and just more than half of the ophthalmologists marked patients before surgery. Often marking was carried out only for certain non-routine procedures. There also seemed to be mixed views on the value of marking, and some resistance was reported from medical staff, especially those who had worked elsewhere where there had been no policy of marking. Although orthopaedic surgeons tended to believe that marking was essential for safe practice, others from urology and ophthalmology thought that marking did not provide any additional benefits to existing checks. Some even believed that marking could compromise patient safety

For example, many believed that marking encouraged a tendency to rely on the mark rather than additional checks, especially when time was short.

> I also believe that marking the site is counter-productive. I believe that it actually makes the final check by the person operating more likely to be incorrect because you can confirm at that final stage with the patient and by looking at the notes and the consent form that you are operating on the correct site and, if the site of surgery is marked, then there is a tendency to go with the mark rather than the final check and if the mark's in the wrong place then you don't recheck it.
> (Participant 38, consultant ophthalmologist, hospital 13)

Others noted the possibility of marks being inadvertently rubbed or wiped off during surgical preparation, disappearing once the skin was stretched, or no longer being visible once the patient was positioned.

> With a kidney, it is possible for the site to be marked correctly but, because the patient would have been on their side, it could have been hidden.
> (Participant 1, consultant urologist, hospital 1)

Some also expressed concern that reliance on staff other than the operating surgeon to do the marking was inherently dangerous.

> We don't know who put the mark on; it could have been a locum SHO who marked the patient the evening before and marked on the wrong side. The marking is valueless unless it has a provenance to back it up.
> (Participant 10, consultant urologist, hospital 4)

Some of the orthopaedic consultants believed that the strong tendency among orthopaedic surgeons to mark patients before surgery was a result of the fact that most orthopaedic surgeries involved the limbs and sides. Despite this, qualitative data showed that some of those who marked did not do so all the time, and were not necessarily committed to the practice of marking.

Marking among ophthalmologists and urologists was more varied. Some ophthalmologists marked all their patients, whereas others tended to mark only for specific procedures, such as removal of an eye. Other circumstances in which marking was considered included plastic surgery, cases where the pathology is not visible, requests from the anaesthetist and cases where the patient is unable to give informed consent.

Similarly, urologists varied between those who always marked and those who marked only under certain circumstances, such as where there was potential for confusion or ambiguity over the side, for stomas and for abnormalities that may not have been visible when the patient is asleep.

METHODS OF MARKING

We found variations in marking methods between the consultants interviewed. Most of those who marked before surgery used a black indelible pen, with the exception of ophthalmic surgeons. The symbol used to mark the patient tended to be an arrow. Some doctors carried their pens with them; others would use whatever came to hand, indelible or not, including felt-tip pens and biros.

However, there was some variation in the site of marking. For instance, some ophthalmologists marked on the forehead, whereas others marked on the cheek. When choosing a method of marking, ophthalmic surgeons had to weigh up the risks of the mark being removed before surgery with ease of removal after surgery. In other specialties, where the length of time between marking and surgery might have been longer, it was more important to use an indelible method. One consultant solved the problem of durability by using needle scratches in cases where there was a risk that the mark might wear off. Some participants initialled the arrow to indicate that the operating surgeon had done the marking.

Only one consultant (orthopaedic surgeon) identified the side without using some sort of pen. In this case, nurses on the ward draped the appropriate limb with a green towel. However, another consultant mentioned a system, used by a colleague, of covering the eye that was not to be operated on, and one ophthalmologist in a department that

had experimented with adhesive dots apparently still continued to use this method.

Concerns about marking

Participants cited several practical reasons that militated against marking patients. Several participants observed that, as patients were no longer admitted the day before surgery, they would usually be seen before a bed had become available and would be fully clothed.

One urologist described the impossibility of intimate marking.

> The emphasis is on hot-bedding patients. Patients won't come into a bed before the operation; they come into the so-called ''arrivals lounge'' and it's a nightmare there. How on earth in an arrivals lounge, in this sort of set up, are you going to sort of strip the patient to put the mark on and privacy and so on.
> (Participant 13, consultant urologist, hospital 5)

The distance between wards and theatres was also cited as a barrier to marking patients before surgery.

> A cataract operation takes 15 minutes; you've got the next patient lined up ready to go; are you going to take time out when our department is two to three minutes down the corridor, put an arrow on and check them and then come back?
> (Participant 8, consultant ophthalmologist, hospital 2)

In one department, marking patients preoperatively had been abandoned. Similarly, another department reported marking patients in the anaesthetic room rather than on the ward.

Others were concerned that they were no longer able to get to know their NHS patients sufficiently well preoperatively compared with their private patients, and had thereby lost one of the most important safeguards against wrong site surgery. In private hospitals, marking patients was not always considered necessary as the volume of work is less and as a result there is considered to be less risk than in NHS hospitals.

> Privately, I don't mark. I do the lens checking but, privately, you know the patients so much better that it's not an issue. NHS is a high volume system, private is low volume. Their [patients'] pupil is dilated so, in a way, you have marked it, which I check beforehand with the consent form. In the NHS it is multiple surgery from a multiple team so the possibility of error is higher and marking does help.
> (Participant 32, consultant ophthalmologist, hospital 10)

Among those who did not mark, reasons given for not marking varied. Few ophthalmologists marked for routine procedures which were conducted under local anaesthetic, where the consequences of operating on the wrong eye were often considered to be not serious, and where marking would involve invisible facial marks. Urologists, on the other hand, pointed out that many procedures where side is an issue are carried out under general anaesthetic and any marking would be invisible once the patient is fully draped.

Another concern among urologists was that, unlike patients in ophthalmology and orthopaedic wards, patients in urology wards are often unable to identify the correct side or site themselves and surgeons must rely on the evidence of an *x* ray and other investigations.

WHO DOES THE MARKING?

The NPSA Correct Site Surgery Alert[9] recommends that marking should be undertaken by the operating surgeon, or nominated deputy, who is present in the operating theatre at the time. However, just over half of the surgeons interviewed carried out the marking themselves.

In general, those surgeons who marked before surgery seemed to feel strongly about making the mark themselves. However, the marking was sometimes delegated to juniors, which some consultants thought was a weakness in the system.

> Another weak point could be if a patient has not been seen by the consultant prior to surgery and juniors can make a mistake by pointing or putting an arrow to the wrong side or consenting to the wrong side.
> (Participant 2, consultant orthopaedic surgeon, hospital 1)

Some consultants pointed out that, although desirable, it was not always possible to mark the patient themselves, mainly due to pressures of time and being called away unexpectedly.

> In one hospital, for instance, it is five stories up. Are you going to stop for half an hour while you go up and mark or are you going to delegate someone else to put a mark on?
> (Participant 8, consultant ophthalmologist, hospital 2)

In some departments, it was normal practice for the person doing the marking to assist in theatre, which is in line with the NPSA guidance; in others, greater emphasis was placed on trained personnel doing the marking. There seemed to be some tension between the weight given to being physically present during the ensuing surgery and that given to having sufficient knowledge of the relevant procedures; thus, in one department, insistence that marking be undertaken by the surgeon who performed the operation had been abandoned in favour of trained personnel.

DISCUSSION

The results of this study suggest that marking before the release of the national guidance was not universal practice. This is despite evidence in the literature that marking patients before surgery decreases the incidence of wrong site surgery.[10] Moreover, few trusts seemed to have official surgical marking policies, and marking practices varied according to specialty and even individual consultants. Surgeons were divided on the value of marking and varied in their practices. Orthopaedic surgeons reported marking all patients before surgery, whereas urologists and ophthalmologists reported varying practice from marking all patients, to marking for certain operations or procedures or even adopting a practice of no marking. In addition, some surgeons even believed that marking could compromise patient safety.

The sample hospitals chosen may not be representative of all hospitals in the UK and the specialties chosen may not reflect practice in other specialties where marking is relevant. However, we found no differences in the responses between the three groups of hospitals selected for this study. The three specialties selected are those where wrong site surgery is common, although the practices described may not have reflected behaviour in other specialties. Given the time scale for the study and limited resources available, methods of data collection included a combination of face-to-face and telephone interviews, which may have encouraged participants to respond in different ways. Researchers have suggested that some participants may feel more comfortable

discussing sensitive topics in the disembodied environment of telephone interviews.[17] However, no differences between the telephone and face-to-face accounts were discernible.

Several possible reasons exist for the variations in marking practice. The results of this study indicate that they fit into five major themes: the sociology of the medical profession, specialty variations, practical reasons for variations in marking practice, organisational variations and variations that arise from individual experience.

Variations in marking practice may be partly a reflection of a known desire among doctors for self-regulation.[18] Indeed, the interviews suggest that, although some departments had specific procedures for marking, doctors often adapt these procedures to meet their own specific requirements. Moreover, we found clear differences in practice between specialties. Most notably, orthopaedics marked all patients before surgery, whereas reported practice among urologists and ophthalmologists ranged from those who did not mark to those who did. Previous research supports the possible existence of subcultures.[19] Such a strong tendency among orthopaedic surgeons to mark may also be a result of the fact that orthopaedic surgeons are more likely to be affected by litigation than surgeons in urology or ophthalmology (Cowan J. Personal communication 2006).[20]

The consultants interviewed, however, linked interspecialty differences in practice to the differing nature of the surgery performed rather than to interspecialty differences in medical culture. The results suggest that insistence on universal marking for all procedures involving side or level and on standardisation of practices may be resisted, and that such resistance is likely to manifest itself along specialty lines. Moreover, such resistance may be a reflection less of interspecialty subcultures, which may be amenable to change, than of variations in practice that have evolved to accommodate the exigencies of surgical work in different specialties.

Another major reason for variations in marking practice centred around the practical problems associated with marking: structural barriers, such as the distance between wards and theatres, were mentioned on several occasions. The imposition of a standard marking policy in such circumstances may well be met with some resistance, as the marking of patients before surgery becomes impractical.

Variations in marking practice were also evident between organisations. Where consultants worked at several different hospital sites, they would have to adopt different marking policies accordingly. This may be a reflection of the different cultures across organisations.[21] A national policy may be helpful to those working at different hospitals to reduce confusion and therefore risk among healthcare professionals. However, past experience of wrong site surgery is also likely to influence people's adoption of the national policy on wrong site surgery.[22]

The nature of surgery is changing in terms of types of procedures, volume and patient throughput. Surgeons are less able to get to know their patients personally before their operations, and their work is becoming more and more narrowly circumscribed to the core surgical skills used at the operating table. This trend is likely to accelerate when patients are able to choose the hospital in which they wish to have their procedure performed, and personal links and continuity are broken. In addition, there is likely to be more multisite working where surgeons are working with staff and equipment with which they are unfamiliar, with the introduction of specialist treatment centres, NHS contracts with the private sector and with surgeons from other countries, and other initiatives to reduce waiting lists. In such changing circumstances, the adoption of standard practice may well be a necessary compromise. It may also bring into sharper focus the role of other staff, especially nurses who may provide more continuity, and also have a tradition of more protocol-driven care.

Key messages

- At the time of the study, there was little evidence of formal or standard policies regarding marking in the sample studied.
- Marking practices and methods among the participants varied considerably and ranged from those who always mark (in the case of orthopaedic surgeons) to those who never mark or mark only occasionally.
- Standardisation of marking practices has potential advantages, particularly as surgeons often work at different hospital sites. The differences between specialties and the effect of local circumstances do, however, need to be considered if guidance aimed at preventing wrong site surgery is to be effective.
- Some resistance could exist against a standard policy on preventing wrong site surgery. Indeed, even those who marked routinely did not always show total commitment to the practice of marking. However, given that surgeons often work across multiple sites, a standard policy on preventing wrong site surgery may become necessary.

CONCLUSION

Participants rarely identified failure to mark as a contributory factor in cases of wrong site surgery. It was only seen as a potential safety issue among some orthopaedic surgeons and nurses.

There may be a trade-off between the advantages of creating a national marking policy and the potential disadvantages caused by the displacement of a national policy, which threatens to disrupt local systems adapted to particular circumstances that seem to be working well. This type of exploratory research could usefully inform the development and implementation of national safety guidelines with practitioners.

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