



Recognising and dealing with complications in orthopaedic surgery

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ABSTRACT

Orthopaedic surgeons need information about the complications they are likely to encounter. The literature on complications is difficult to interpret owing to a lack of agreed definitions, problems with collecting accurate data and with data interpretation. We suggest a role for the Royal College of Surgeons and specialist societies in collecting and interpreting complications data.

KEYWORDS

Orthopaedic – Complications

Accepted 14 November 2016

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Every surgeon needs to be able to inform patients of the likely complications of a proposed operation. A knowledge of complications is also required for other aspects of modern orthopaedic practice:

- > Surgeons are required to analyse complications to participate in clinical governance and appraisal.¹
- > Complications are a common cause of litigation against UK orthopaedic surgeons and data are required to defend claims.²
- > A knowledge of complications is necessary when surgeons explain complications to patients as required by the duty of candour.³

The aim of this narrative review was to provide an overview of the medical informatics of (orthopaedic) complications. Outcome measures were not part of this review.

What is a complication?

In orthopaedic surgical practice, complications are often recognised quickly and intuitively (Figs 1 and 2). Analysis in the literature is more difficult. There is no standard definition of a surgical complication; the definition of a complication is often assumed to be understood but it is seldom provided. For example, the first issue of the *Journal of Orthopaedic Complications* discussed complications but did not provide a definition.⁴

The literature notes the difficulties encountered in applying definitions of complications. Sokol and Wilson's defined a surgical complication as 'any undesirable, unintended,

and direct result of an operation affecting the patient, which would not have occurred had the operation gone as well as could reasonably be hoped [...] a surgical complication is not a fixed reality [...] it is dependent on the level of surgical skill and the facilities available'.⁵

Considering the surgical environment in the National Health Service (NHS), our own definition of a complication would be that it is any less than perfect outcome that increases the cost of treatment. However, while researching the literature, it became clear that many different terms are used when discussing complications. For clarity, these are considered below.

Risk: This is a term used on consent forms for surgical procedures. It is not further defined.⁶ Many surgeons use the surgical consent form to estimate for patients the rate of common complications. This includes mainly surgical complications particular to the procedure; the general medical complications are often less well defined.

A sequela is an 'after effect' of surgery that is inherent to the procedure. Sequelae and complications need to be carefully distinguished. The following are normal sequelae of surgery but are not often complications: scarring, swelling and bruising.⁷

Failure to cure: Surgery may be well executed without any complications but still fail. If the original purpose of surgery has not been achieved, this is not a complication but a 'failure to cure' (eg residual tumour after surgery). Sequelae and failure to cure are usually not included as complications.⁸

Morbidity: The definition of morbidity is 'The condition of being diseased' and 'The rate of disease in a population'.⁹ In



Figure 1 Infected fixation of proximal humerus with loss of position



Figure 2 Dislocated hip hemiarthroplasty

common use ('morbidity and mortality meeting'), morbidity seems to refer to non-fatal complications. 'Morbidity' can be used inappropriately: a publication from 2016 concerning shoulder surgery stated: 'Despite a high rate of post-operative complications, the morbidity of Latarjet procedure remains low.'¹⁰

Medical error is defined as an unintended act (either of omission or commission) or one that does not achieve its intended outcome, the failure of a planned action to be completed as intended (an error of execution), the use of a wrong plan to achieve an aim (an error of planning), or a deviation from the process of care that may or may not cause harm to the patient. Patient harm from medical error can occur at the individual or system level.¹¹

Negligence: Cases of surgical negligence constitute a subset of surgical complications.⁵ Medical negligence is proved if all components of the three-part test are established on the balance of probabilities (civil suit) or beyond reasonable doubt (criminal prosecution). The three-part test establishes that the doctor owed a duty of care to the patient, that the duty of care was breached and that as a direct result of the breach, the patient suffered harm.¹²

It is not acceptable to state as a defence that the relevant complication was within an acceptable range of incidence. In some countries, a complication occurring at an incidence of less than 2% is eligible for automatic compensation. Examples include an unusual drug reaction or an infection after knee replacement.¹⁵

Serious incidents are events where the 'potential for learning from some incidents in healthcare is so great, or the consequences to patients, families and carers, staff or organisations are so significant that they warrant using additional resources to mount a comprehensive response'.¹⁴ All 'never events' are serious incidents.

Never events are serious incidents that have the potential to cause serious patient harm or death. They are wholly preventable as guidance or safety recommendations that provide strong systemic protective barriers are available at a national level and should have been implemented by all healthcare providers. Serious harm or death is not required to have happened as a result of a specific incident occurrence for that incident to be categorised as a never event.¹⁵

Adverse events: These are instances that indicate or may indicate that a patient has received poor quality care.¹⁶ The Department of Health estimates that 10% of hospital inpatient admissions result in an adverse event.¹⁷

Definitions of common complications

Having defined the term 'complication', definitions of each individual complication are required. This is true for both orthopaedic complications (eg stiff joint, instability) and medical complications (eg chest infection, cerebrovascular accident). Again, definitions are not agreed for many common complications.

Even when the definitions have been agreed, there can be confusion if they are not applied correctly. Scrutiny of the definitions used can significantly alter the findings of audit and research. Keong *et al* compared the rates of pressure sore development after total hip replacement in two surgical units.¹⁸ On analysis, it was found that grade 1 pressure sore areas (erythema with no ulceration) were included inappropriately for both units. Correct application of the definitions changed the results considerably (Table 1).

Table 1 The effect of correct versus incorrect use of definitions¹⁸

	Unit A	Unit B
Pressure sore rate before correct use of definition	9.9%	32.4%
Pressure sore rate after correct use of definition	2.3%	1.0%

Collecting data: data quality

The quality of the clinical data can be calculated by multiplying the completeness and accuracy.¹⁹ Several variables affect the quality of data collected. First, the quality of data varies with the type of data collected. Data quality is highest for diagnosis and lowest for complications (with operation data somewhere between the two).²⁰ Second, differences in the means of data collection can also lead to variation of data quality. For retrospectively collected data, around 50% is lost in collection, and there are additional effects resulting from data degradation and bias.²¹

National databases often use retrospectively collected data and the data quality is uncertain.^{22–24} In the UK, the National Joint Registry (NJR) uses data supplied by the NHS. Details of the data quality are not given on the NJR website. In a 2013 assessment of basic NJR data (which ought to be more accurate than data concerning complications), significant errors were found. Of 78 cases inputted, 27 (35%) had errors. Sixteen cases had the incorrect ‘consultant in charge’ recorded, eight cases had the incorrect ‘operating surgeon’ recorded and three cases had both errors.²⁵

The type of clinical data collected affects the data quality. Collecting data on complications due to soft tissue procedures is more difficult than collecting data on joint replacement complications. A study from 2015 attempted to collect data for the most common complication of one of the most common orthopaedic procedures in the UK (postoperative shoulder stiffness after shoulder arthroscopy).²⁶ Attempts by the authors to compare different studies failed as there were no agreed standards or definitions regarding postoperative stiffness. Similarly, a Cochrane review reported it was equally difficult to collect data regarding the diagnosis and management of impingement owing to a lack of agreement of terms.²⁷

When discussing complications, papers concerning procedures involving soft tissue of the shoulder often report shoulder scores and not the (admittedly rare) medical complications. For example, a review of nearly 7,000 shoulder arthroscopies over 5 years reported no medical complications at all.²⁸ Complications following joint replacement are better documented, probably because of the accurate data collection required by national joint registries and because the local complications relating to the joint itself are often documented and measurable on radiographs.²⁹

Many papers regarding the complications of total hip replacement (THR) concern outcome measures and the long-term survivorship of the prosthesis itself. Despite this, there is no ‘consistent universal or standard reporting of

complications after THR in the orthopaedic literature’.³⁰ We were unable to find a publication that comprehensively listed the risks and complications of THR in a way that could be used for a consent form. The reporting of complications after hip replacement seems to be in several common forms:

- > Specialised groups (eg the complication rate after hip replacement in obese patients)²²
- > Immediate local complications for more general groups of patients: They tend to assess mainly the local complications of THR.³¹
- > Medical complications: Others address some (but not all) medical complications. For instance, recent papers have addressed a defined subset of complications³² or only complications that resulted in a length of stay of >4 days.³⁵

Interpreting data: complication rate

Releasing complication rates to the public can be fraught if the data are interpreted incorrectly. A percentage complication rate is often used. Using this single figure to assess complications is difficult, and requires careful data collection and analysis. A low complication rate may mean poor data collection while a high complication rate may mean stringent and careful data collection. Any surgical procedure is likely to have a complication rate of 10% or more. Any rate less than this is likely to indicate poor data collection.²⁰

The ProPublica website in America publishes named surgeons’ complications.³⁴ The information is derived from five years of Medicare data. A common complication rate varying between 2% and 4% is reported. It is suggested, however, that ‘the typical surgeon’s rate can and should be significantly lower. The evidence: Some 756 surgeons who each did at least 50 operations did not record a single complication in the five years covered by the analysis. Another 1,423 had only one’.³⁴

ProPublica further assumes that complication rates were often attributable to ‘random bad luck. A surgeon with raw complication rates as high as 14 percent could have an adjusted rate as low as 7.6 percent [...] surgeons with no complications benefitted from at least some good luck. Therefore, the lowest adjusted complication rate any doctor can reach is 1.1 percent’.³⁵

Data analysed in this way can be misleading. Surgeons who carefully collect data and have a complication rate of over 10% are likely to be used as examples of poor practice. Surgeons who fail to collect complications data will have a low complication rate and be used as examples of good practice.

Conclusions

The literature concerning the definitions, collection and interpretation of data regarding complications is often difficult to interpret. This causes problems in the comparison, analysis and improvement of surgical practice.

We suggest that The Royal College of Surgeons of England and Public Health England jointly begin a standardised

system of complications data collection and analysis, relying heavily on online data collection. This will involve defining what a complication is, defining each complication, giving a defined follow-up period for each procedure (sometimes long after discharge), and suggesting how data could be collected and compared.

The NJR concept of online data reporting could allow interested parties to initiate reporting and comparison of data online. This could be done for a wide range of surgical procedures, perhaps with assistance from specialist societies. The data could be reported in a format similar to those in the 1992 confidential comparative audit of the Royal College of Surgeons.⁵⁶ The costs would be mainly administrative and relatively low. Only with such a system can complications data be analysed and compared with confidence, and meaningful conclusions reached.

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