Complications in Orthopaedic Literature; how well are they reported?
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Introduction

The occurrence of adverse events in surgery is a topic that receives a high level of attention from both within the NHS, and outside agencies such as the media and patient advocacy groups. The quality and detail of complication reporting in Orthopaedic literature is often variable, and papers can be limited to commenting on major and minor complications with little explanation as to their exact nature and long-term sequelae.

There are increasing numbers of publications every year in orthopaedic journals, and the variability of complication reporting places a growing burden of responsibility on journal editors and reviewers to ensure that their publications sufficiently report complications.

There is also increasing pressure on Orthopaedic Surgeons to minimise operative complications within their practice. It is currently estimated that complications due to infected Total Hip Replacement and Total Knee Replacement cost the NHS £200-300 million per year. In the 2013-2014 financial year, there were 683 closed claims secondary to Orthopaedic complications within the NHS. These claims amounted to £51,896,281.20 in claim damages, £29,292,145.59 in claimant costs and £6,364,595.75 in Defence Costs. The accurate reporting of complications is required to aid clinicians in their management of Orthopaedic patients.

In 2002 Martin et al published a review of how complications were reported after general surgical procedures (specifically pancreatectomy, oesophagectomy and hepatectomy). Within this study they identified 10 criteria that they felt were required for adequate reporting of post-operative adverse events.

This study aims to evaluate the quality of Orthopaedic literature in relation to the reporting of complications. The criteria specified by Martin et al were used as the basis for assessing how well published orthopaedic papers have reported their post-operative complications.

Method:

Articles from five major orthopaedic journals were reviewed by the authors to assess their compliance with Martin et al’s 10 criteria. Table 1 demonstrates how these criteria were modified from the original paper in order to be applicable to orthopaedic procedures. In addition to assessing each article for its quality of adverse event reporting, we used the modified Dindo criteria (Table 2) to quantify the severity of each complication.

Every article published in the selected five journals in the year 2014 which pertained to procedures carried out on live patients was included in the study. Case reports, cadaveric studies, and technical reports were excluded. Three hundred and ninety eight articles were included in the initial analysis. After reviewing these articles, we excluded all those which positively reported that they had observed no complications in their cohort. We also excluded those articles that failed to mention complications, or did not provide enough information to assess both the number and type of complication. Following these exclusions, we were left with 250 articles that were assessed using the 10 criteria. Table 3 shows the journals reviewed, and the number of articles from each which met the inclusion criteria.

The 250 articles reported data on 3,619,281 patients and focused on a wide range of topics. If an article was specifically designed to look at one complication, the reporting of this complication was not assessed by the reviewers. However, any other complications reported in these studies were assessed.
Each publication was assessed for its compliance with the modified criteria. Where complications were described, the reviewers attempted to score their severity according to the Modified Dindo Score\(^3\). This was only possible in 204 articles, as several did not include sufficient information.

### Table 1

<table>
<thead>
<tr>
<th>Original criteria</th>
<th>Modified criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Method of accruing data defined</td>
<td>Prospective or retrospective accrual of data is indicated</td>
</tr>
<tr>
<td>2 Duration of follow up indicated</td>
<td>Report clarifies the time period of post-op accrual of complications (e.g. 30 days)</td>
</tr>
<tr>
<td>3 Outpatient information included</td>
<td>Study indicated that complications first identified following discharge are included in the analysis</td>
</tr>
<tr>
<td>4 Definitions of complications provided</td>
<td>Article defines at least one complication with specific inclusion criteria</td>
</tr>
<tr>
<td>5 Mortality rate and causes of death listed</td>
<td>The number of patients who died in post-operative period are recorded together with cause of death</td>
</tr>
<tr>
<td>6 Morbidity rate and total complications indicated</td>
<td>The number of patients with any complication and the total number of complications are recorded</td>
</tr>
<tr>
<td>7 Procedure-specific complications included</td>
<td>Dependent on the procedure being reported</td>
</tr>
<tr>
<td>8 Severity grade utilised</td>
<td>Any grading system designed to clarify severity of complications including ‘major and minor’ is reported</td>
</tr>
<tr>
<td>9 Length of stay data</td>
<td>Median or mean length of stay indicated in the study</td>
</tr>
<tr>
<td>10 Risk factors included in analysis</td>
<td>Evidence of risk stratification and method used indicated by study</td>
</tr>
</tbody>
</table>
Table 2

<table>
<thead>
<tr>
<th>Dindo 0</th>
<th>No quality of care concerns evident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dindo 1</td>
<td>Deviation from the usual post-op course which leads to increased length of stay or requires a temporary medical program (e.g. ileus, pain management, anti-emetic). This includes wounds that are opened at the bedside.</td>
</tr>
<tr>
<td>Dindo 2</td>
<td>Complication that requires pharmacological or minor surgical intervention (cast saw injury, cellulitis, low grade decubitus ulcer, wound infection managed with oral antibiotics)</td>
</tr>
<tr>
<td>Dindo 3</td>
<td>Complication that requires surgical or medical intervention and has the potential to affect the patient’s functional outcome (wound infection managed with intravenous antibiotics, wound washout for haematoma or infection, hardware or graft failure, osteotomy malposition, re-operation for original indications)</td>
</tr>
<tr>
<td>Dindo 4</td>
<td>Life threatening complications that resolved (organ failure, excessive blood loss, unexpected ICU stay) or limb complication resulting in temporary or permanent functional loss (peripheral nerve injury, compartment syndrome)</td>
</tr>
<tr>
<td>Dindo 5</td>
<td>Death; a sentinel event (wrong surgical site); or a complication leading to major functional loss (CNS injury, paralysis, loss of limb)</td>
</tr>
</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>Journal</th>
<th>Number of articles</th>
<th>Number of excluded articles</th>
<th>Number of articles included</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Journal of Shoulder and Elbow Surgery</td>
<td>54</td>
<td>9</td>
<td>45(4-48)</td>
<td>4186</td>
</tr>
<tr>
<td>Spine</td>
<td>66</td>
<td>24</td>
<td>42(39-90)</td>
<td>926,639</td>
</tr>
<tr>
<td>Journal of Arthroplasty</td>
<td>125</td>
<td>39</td>
<td>86(93-176)</td>
<td>555,301</td>
</tr>
<tr>
<td>Bone and Joint</td>
<td>100</td>
<td>36</td>
<td>64(177-240)</td>
<td>1,422,225</td>
</tr>
<tr>
<td>Foot and Ankle International</td>
<td>53</td>
<td>40</td>
<td>13(241-254)</td>
<td>710,930</td>
</tr>
<tr>
<td>Totals</td>
<td>398</td>
<td>148</td>
<td>250</td>
<td>3,619,281</td>
</tr>
</tbody>
</table>

Results

After exclusions, 250 articles reporting 3,727,373 procedures in 3,619,281 patients were included in the study. These articles covered a wide range of procedures performed on both paediatric and adult patients. Most articles described data collected in the UK and United States, but we also looked at papers submitted from South Korea, Japan, Burkina Faso, Australia, New Zealand, and Northern Europe. Table 4 shows a detailed breakdown of the type of studies reviewed, and the numbers of each.

Table 4

<table>
<thead>
<tr>
<th>Type of study</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case series</td>
<td>124</td>
</tr>
<tr>
<td>Cohort Study</td>
<td>91</td>
</tr>
<tr>
<td>National Database Review</td>
<td>8</td>
</tr>
<tr>
<td>RCT</td>
<td>20</td>
</tr>
<tr>
<td>Systematic Review</td>
<td>6</td>
</tr>
<tr>
<td>Metaanalysis</td>
<td>1</td>
</tr>
</tbody>
</table>

No article described their complications in sufficient detail to meet all 10 criteria. One article achieved a score of nine, with a mean of five and a mode of four. Taking each journal individually, The Journal of Shoulder and Elbow Surgery had the highest proportion of articles scoring above the mean number of criteria. The number of patients included in the study appeared to have no bearing on the quality of adverse event reporting. We noted that some criteria were more consistently mentioned than others, and a detailed breakdown of scores for each criterion is shown in Table 5. No criterion was met by every study, but the method of accruing data (Criteria 1) was most consistently reported. Very few studies indicated their length of stay data, or demonstrated that they had stratified patients according to their risk of postoperative complications.
Table 5

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Compliance n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>237 (94.8)</td>
</tr>
<tr>
<td>2</td>
<td>224 (89.6)</td>
</tr>
<tr>
<td>3</td>
<td>214 (85.6)</td>
</tr>
<tr>
<td>4</td>
<td>219 (87.6%)</td>
</tr>
<tr>
<td>5</td>
<td>43 (17.2)</td>
</tr>
<tr>
<td>6</td>
<td>167 (66.8)</td>
</tr>
<tr>
<td>7</td>
<td>203 (81.2)</td>
</tr>
<tr>
<td>8</td>
<td>46 (18.4)</td>
</tr>
<tr>
<td>9</td>
<td>13 (5.2)</td>
</tr>
<tr>
<td>10</td>
<td>4 (1.6)</td>
</tr>
</tbody>
</table>

If a single procedure-specific complication was defined by the study (e.g. dislocation following total hip arthroplasty) we gave the point for having met criterion 7. Typical major complications (Dindo 3-5) reported were PE, myocardial infarction, nerve palsy, and revision of original operation. There was variation in the way in which complications were reported. Some studies stated their total morbidity either in numbers, percentages, or both. Some relayed all their complications in anecdotal form, and some presented data for their whole cohort in table form, of which complications formed part.

The criteria most consistently missed were risk stratification, and length of stay data. We also noted that post-operative mortality was frequently not reported. Studies focusing on trauma rather than elective procedures were more likely to mention mortality. Severity grading, when mentioned, was confined to either major or minor in the vast majority of studies, with only one article mentioning the Dindo criteria. Whilst several studies mentioned the comorbidities, very few made any connection between these and the number of complications encountered.

In most studies, there was little or no data on Dindo 1 complications, and we believe that these events may be underreported in the orthopaedic literature.

Discussion

Adverse peri-operative events are regularly reviewed at a local hospital level by orthopaedic surgeons. Through regular morbidity and mortality meetings, we aim to identify areas in which patient care could be improved, and to decrease rates of complications through identifying patterns. However, this quality of complication reporting has not progressed to the surgical literature. A vast quantity of data exists on surgical technique, and on patient outcomes as measured by scores such as the Constant score, the Harris hip score, and the Oxford knee score. However, patient outcomes in terms of adverse events and complications are not so consistently reported.

Patient outcomes are under more scrutiny than ever, and reporting of adverse events the responsibility of any surgeon carrying out procedures on living patients. Due to the high level of scrutiny, it is possible that complications are going unreported, or undiscussed, due to concerns about negative feedback. It is important that post-operative complications are reported and discussed in order to drive quality improvement.

It is possible that poor quality of complication reporting in orthopaedic literature is due to a lack of agreed criteria for such reports. In this study, no articles met the ideal standard of reporting, and only 26% met five or more of the criteria. Some areas were consistently missed, regardless of the main focus of the study. Given the lack of consistency in quality of complication reporting, it is currently very difficult to compare studies, and therefore extract valuable information.

In most studies, there was little or no data on Dindo 1 complications, and we believe that these events may be underreported in the orthopaedic literature. It is possible that reporting of these complications goes hand in hand with reporting length of data, as the two are directly related. We therefore believe that using a consistent set of criteria could also lead to an improvement in the reporting of complication severity.
References


199. R Schuh et al., Vascularised or non-vascularised autologous fibular grafting for the reconstruction of a diaphyseal bone defect after resection of a musculoskeletal tumour. Bone Joint J 2014;96-B:1258–63.


187. G. S. Matharu et al., Predictors of time to revision and clinical outcomes following revision of metal-on-metal hip replacements for adverse reaction to metal debris. Bone Joint J 2014;96-B:1600–9
191. N. Ahearn et al., The outcome following fixation of bicondylar tibial plateau fractures. Bone Joint J 2014;96-B:956–62
203. B. S. Dhinsa et al., The outcome of resection of the distal ulna for tumour without soft-tissue or prosthetic reconstruction. Bone Joint J 2014;96-B:1392–5.
207. Y. K. Lee et al., Comparison between 28 mm and 32 mm ceramic-on-ceramic bearings in total hip replacement. Bone Joint J 2014;96-B:1459–63.
210. V. Kumar et al., Total hip replacement through a posterior approach using a 22 mm diameter femoral head. Bone Joint J 2014;96-B:1202–6.
214. C. Middleton et al., A reverse shoulder arthroplasty with increased offset for the treatment of cuff-deficient shoulders with glenohumeral arthritis. Bone Joint J 2014;96-B:936–42
217. M. T. Brown et al., How safe is curettage of low-grade cartilaginous neoplasms diagnosed by imaging with or without pre-operative needle biopsy? Bone Joint J 2014;96-B:1098–105.
238. Xin Tang et al., Comparison of Early and Delayed Open Reduction and Internal Fixation for Treating Closed Tibial Pilon Fractures. Foot & Ankle International® 2014, Vol. 35(7) 657–664


248. Werner Siekmann et al., Correction of Moderate to Severe Hallux Valgus With Isometric First Metatarsal Double Osteotomy. Foot & Ankle International® 2014, Vol. 35(11) 1122–1130

249. Mark S. Myerson et al., The Management of Infection Following Total Ankle Replacement: Demographics and Treatment. Foot & Ankle International® 2014, Vol. 35(9) 855–862