Supracondylar fractures of the humerus in children: is departmental documentation hitting national standards?

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Abstract

Background/Aims The British Orthopaedic Association's Standards for Trauma for the management of supracondylar humerus fractures in children specify that: 'A documented assessment of the limb, performed on presentation, must include the status of radial pulse, digital capillary refill time and the individual function of the radial, median (including anterior interosseous) and ulnar nerves.'

Methods The documentation of cases of supracondylar humerus fractures over 1 year was retrospectively analysed. An electronic pro forma for supracondylar humerus fractures was introduced, with prompts for the pieces of documentation required to meet national standards. The use of this pro forma was audited after 6 months and 12 months use.

Results Documentation ranged from 10% for anterior interosseous nerve to 53% for radial pulse. In the second reaudit, documentation ranged from 86% for anterior interosseous nerve to 95% for median nerve function. There were 17 patients for whom all documentation was present, and for these patients the pro forma had been used. Use of an electronic clerking pro forma improves adherence.

Conclusions Full documentation of neurovascular status in paediatric supracondylar fractures is vital to allow for effective preoperative and postoperative further assessment. With the move into paperless documentation, online pro formas can help clinicians with effective assessment and documentation.

Key words: Audit; Documentation; Neurovascular; Supracondylar

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Reason for the audit

Supracondylar fractures of the humerus are the most common paediatric elbow fractures, accounting for 3% of all children's fractures. The most common age of injury is 5–7 years (Azar et al, 2017). Neurovascular complications are reported in 5–19% of displaced fractures, as a result of the close proximity of structures such as the brachial artery and the anterior interosseous nerve. Extension-type fractures are the most common (97–98%), with flexion-type fractures rarely encountered (2–3%) (Barr, 2014).

The modified Gartland classification is the most accepted classification, and neurovascular complications are mostly associated with more displaced fractures: types IIIA, IIIB and IV. The accepted treatment for a displaced fracture has historically successfully been closed reduction using traction and hyperflexion (Potts, 1929), with fixation using Kirschner wires routinely used in modern practice (Havranek et al, 2018; Zhou et al, 2018; Dineen et al, 2019). Displaced fractures causing neurovascular compromise almost always require surgical intervention for stabilisation with additional exploration of the brachial artery, and sometimes nerve exploration (Kumar and Singh, 2016).

British Orthopaedic Association (2020) trauma guidelines state that the absolute requirement for a documented assessment of the limb, performed on presentation, should include the status of the radial pulse, digital capillary refill time and the individual function of the radial, median (including anterior interosseous) and ulnar nerves. It is therefore no longer acceptable to write phrases such as 'neurovascularly intact' as a general statement to cover all structures.

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In the authors' trauma and orthopaedic department at East Surrey Hospital in the UK, senior house officers see new patients presenting in the emergency department. An initial audit analysed how well this team adhered to these national guidelines. Detailed and effective clinical documentation is key to the safe practice of any clinician; surgeons need to know the preoperative neurovascular status of these fractured limbs in order to assess the effectiveness of the reduction intraoperatively, understand how urgently that patient needs surgical intervention, and to protect themselves from claims that could be made regarding intraoperative neurovascular damage. The authors sought to develop an electronic patient record protocol to facilitate adherence to national guidance, and provide the optimal orthopaedic care for these patients.

This article presents two full audit cycles to assess the impact of this intervention and its long-term benefit.

Criteria to be measured

- Age of patient
- Gartland classification
- Date of injury
- Laterality of injury
- Documentation of:
  - Radial pulse
  - Capillary refill time
  - Radial nerve function
  - Ulnar nerve function
  - Median nerve function
  - Anterior interosseous nerve function
- Does the documentation just say 'neurovascularly intact' or words to such effect without specifying individual nerve/vascular capacity
- Any other comments

Standard set

The British Orthopaedic Association's (2020) standards for trauma for supracondylar fractures of the humerus in children specify that:

> **'A documented assessment of the limb, performed on presentation, must include the status of radial pulse, digital capillary refill time and the individual function of the radial, median (including anterior interosseous) and ulnar nerves.'**

The department should be achieving 100% adherence to this standard.

Preparation and planning

In order to assess current compliance with standards, the documentation for cases of supracondylar fractures of the humerus in a 1-year period (1/01/2019–31/12/2019) was retrospectively analysed. Cases to be investigated and analysed were initially chosen using the following inclusion criteria using the hospital patient tracking system which is the legal record of all patients referred to and seen by the orthopaedic department.

Initial inclusion criteria:

- Patient seen by the orthopaedic senior house officer
- Diagnosis of fracture to the elbow recorded by the senior house officer.

Cases were then investigated by the authors, and subsequent exclusion criteria applied:

- Cases not physically seen by the orthopaedic senior house officer (referred for advice only) or referred by the emergency department
- Those who did not sustain a supracondylar fracture of the humerus on X-ray or cross-sectional imaging
- Cases in patients that were not 0–18 years of age.

The authors then requested the notes for the cases included, and carefully read all available documentation in them, recording the criteria to be measured on a bespoke spreadsheet.

Results of data collection

There were 39 cases found in the initial period where supracondylar fracture of the humerus had been recorded by a senior house officer. Of these 39 cases, four were omitted in line with the exclusion criteria. Figure 1 shows a flow diagram of case selection.

Of the 35 cases analysed, five had no documentation (electronic or paper) that could be located relating to their elbow injury. All five cases had imaging confirmation of the fracture and of further contact with healthcare professionals relating to the injury, whether this was evidence of an operation or follow up in fracture clinic.

The age range of patients was 1–12 years, with an average age of 5.9 years and mode age of 6 years. The number of patients sustaining each Gartland classification is outlined in Table 1.

Table 2 shows the adherence to national guidance from the first audit data. There was no documentation of any separate neurovascular structure for 10 patients. Of these, eight had the words 'neurovascularly intact' documented, and two had no mention of neurovascular structures at all.

Reflections and recommendations

It was clear that the department was not reaching the recommended targets for documentation of neurovascular status of these fractures in children.

The anterior interosseous nerve is particularly neglected, but while some may consider this an easy structure to forget, it is surprising to see that the individual documentation of the radial, median and ulnar nerve also falls below the 20% mark for adherence. Interestingly the anterior interosseous nerve is reportedly the most commonly injured in this fracture, and therefore it is even more imperative that this area is improved.

It is true that historically the phrase 'neurovascularly intact' was considered adequate documentation, but given this new guidance and the increase in medicolegal activity in the UK, it is now more important than ever that junior doctors clerking patients support

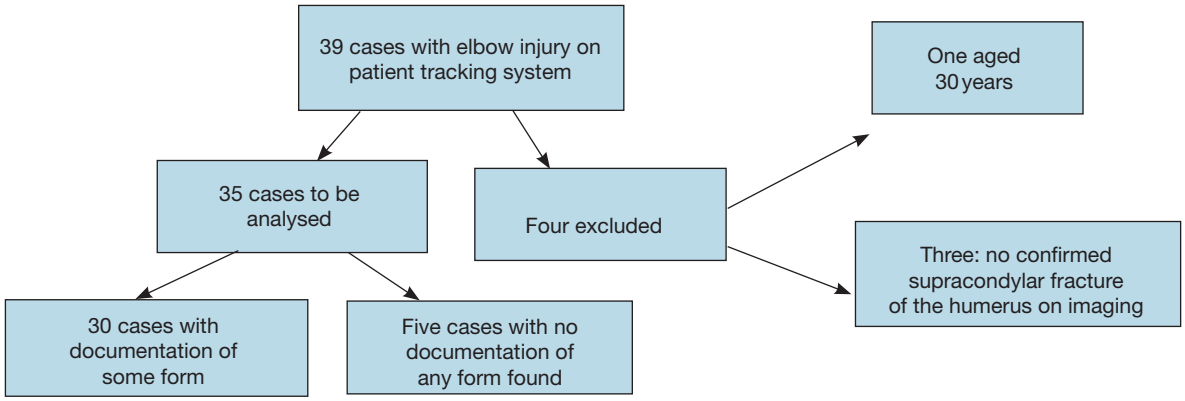

Figure 1. Patient selection for first data collection.

Table 1. Number of patients per Gartland type of supracondylar fractures of the humerus at each stage of data collection

Gartland	No of patients: audit 1	No of patients: reaudit 1	No of patients: reaudit 2
I	14	3	6
II	8	6	5
III	11	7	10
IV	2	8	0

Table 2. Departmental adherence to national guidance for documentation of neurovascular status of supracondylar fractures of the humerus

	Radial pulse	Digital capillary refill time	Radian nerve	Ulnar nerve	Median nerve	Anterior interosseous nerve
Cases requiring documentation	30	30	30	30	30	30
Cases with required documentation	16	12	5	5	4	3
Adherence to national guideline (%)	53	40	17	17	13	10
Aim % adherence to national guideline	100	100	100	100	100	100

consultant colleagues and follow guidance to the best possible standard. Colleagues therefore need educating on the changes to this standard to improve their documentation.

The trust is moving towards a paperless notes status, and after working closely with IT colleagues, a pro forma was launched for clerking supracondylar fractures of the humerus, which is available to all doctors to use. The pro forma is designed so that the standards of documentation previously audited are easily visible to the doctor, which act as a prompt to examine and then record the various criteria necessary (Appendix 1).

Reaudit 1: December 2020

The same criteria for data collection used in the first audit cycle were used for the reaudit. The standard was the same for the reaudit – clinicians should be achieving 100% documentation of all aspects.

Preparation and planning

Retrospective analysis was performed, but over 6 months (12/06/20–12/12/20) rather than a year. Cases to be investigated and analysed were initially chosen using the following inclusion criteria using the hospital patient tracking system.

- Diagnosis of fracture to the elbow recorded by the senior house officer.

If no electronic documentation could be found, the paper notes were obtained and studied. Exclusion criteria and subsequent case selection included followed the same methodology as in the initial audit.

Results of data collection

There were 25 cases where supracondylar fracture of the humerus had been recorded by a senior house officer. Of these, nine were excluded using the exclusion criteria. Figure 2 shows a flow diagram of case selection.

Three patients were excluded as there was no supracondylar fractures of the humerus on assessment of the X-rays, two patients were excluded as their treatment had occurred at an external minor injuries unit and the notes were inaccessible, and four patients were excluded because they were not seen by the orthopaedic senior house officer, but just by an emergency department clinician, and the case was discussed with the senior house officer.

Table 3 shows the adherence to national guidance for documentation of neurovascular status of supracondylar fracture of the humerus for the reaudit.

All 16 cases analysed had documentation of some form. The age range of patients was 2–14 years, with an average age of 6.6 years and mode age of 6 years. The number of patients sustaining fractures of each Gartland classification is outlined in Table 1.

In nine cases the clerking senior house officer had used the pro forma designed and implemented following the first audit. Of these, eight included all the required assessment criteria.

Three of the 16 notes studied included the words ‘neurovascularly intact’ as the summary of the assessment carried out. These were all from a single doctor.

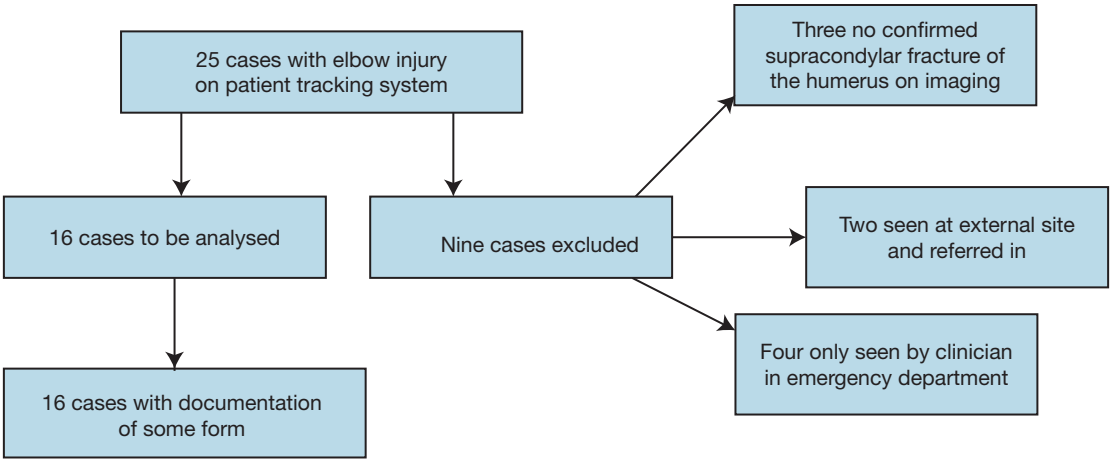

Figure 2. Patient selection for reaudit.

Table 3. Departmental adherence to national guidance for documentation of neurovascular status of supracondylar fractures of the humerus during the first reaudit

	Radial pulse	Digital capillary refill time	Radian nerve	Ulnar nerve	Median nerve	Anterior interosseous nerve
Cases requiring documentation	16	16	16	16	16	16
Cases with required documentation	9	11	10	10	11	8
Adherence to national guideline (%)	56	69	63	63	69	50
Aim % adherence to national guideline	100	100	100	100	100	100

Reflections and recommendations

Documentation improved in all areas outlined in the British Orthopaedic Association's (2020) guideline. While this improvement was noteworthy, it was still a long way from full compliance.

Not all clerking senior house officers were using the electronic pro forma, which was disappointing. The reaudit results showed that when the pro forma was used, the necessary examination findings were well documented, supporting the authors' aims to continue to encourage its use moving forwards. As well as presenting these findings at the local clinical governance meetings, the authors also targeted individual senior house officers on a personal basis to try and improve use of the pro forma.

Four patients were excluded from the data as they were not seen by an orthopaedic senior house officer. Three of these had Gartland type I fractures, and one was a type II fracture. Examination findings were documented electronically by an emergency department clinician, and did not fulfil British Orthopaedic Association's (2020) requirements. Therefore, an unexpected finding from these results was that emergency department clinicians also needed awareness and education in this area. It is appropriate for emergency department clinicians to manage Gartland type I and II conditions after consultation by phone with an orthopaedic doctor, but this does not make these fractures exempt from the documentation requirements outlined in the British Orthopaedic Association's (2020) guidelines. Therefore the findings of this reaudit were presented at in the emergency department clinical governance meeting, and patients seen in the emergency department were included in the next reaudit.

Reaudit 2: May 2021

The same criteria for data collection used in the first audit cycle were used for the reaudit. The standard was the same for the reaudit – clinicians should be achieving 100% documentation of all aspects.

Preparation and planning

Retrospective analysis was again performed, over 6 months (12/12/20–12/05/21). Cases to be investigated and analysed were initially chosen via the following inclusion criteria using the hospital patient tracking system.

- Diagnosis of fracture to the elbow recorded by senior house officer.

If no electronic documentation could be found, the paper notes were obtained and studied. The exclusion criteria of 'Cases not physically seen by orthopaedic senior house officer (referred for advice only)' was removed and these cases included in the data. All other exclusion criteria remained.

Results of data collection

There were 21 cases where supracondylar fracture of the humerus had been recorded by a senior house officer. Of these, none were excluded using the exclusion criteria. Figure 3 shows a flow diagram of case selection.

Table 4 shows the adherence to national guidance for documentation of neurovascular status of supracondylar fracture of the humerus for the second reaudit.

Of the 21 cases analysed, there were no patients with no documentation. The age range of patients was 2–16 years, with an average age of 6.6 years and mode age of 6 years. The number of patients sustaining fractures of each Gartland classification is outlined in Table 1.

In 17 cases the clerking senior house officer had used the pro forma, all of which included all the required assessment criteria. In the three cases where the pro forma was not used, there was varied success of documentation in each category. One note included the words 'neurovascularly intact' as the summary of the assessment carried out. This was by a single doctor. One case was only seen by an emergency department clinician, and in this case all criteria except anterior interosseous nerve function was successfully documented.

Reflections and recommendations

In raising awareness of these national guidelines within the authors' department and also within the wider hospital team, adherence to the guidelines improved substantially after 1 year. Individual documentation regarding function of the anterior interosseous nerve

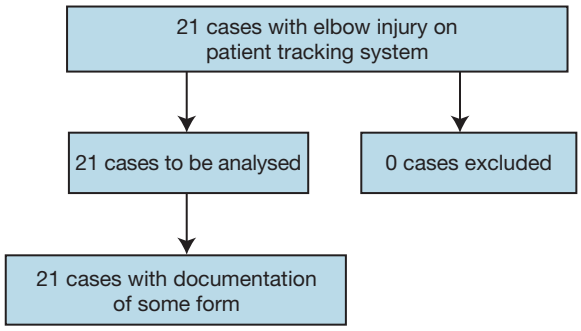

Figure 3. Patient selection for second reaudit.

Table 4. Departmental adherence to national guidance for documentation of neurovascular status of supracondylar fractures of the humerus during the second reaudit

	Radial pulse	Digital capillary refill time	Radian nerve	Ulnar nerve	Median nerve	Anterior interosseous nerve
Cases requiring documentation	21	21	21	21	21	21
Cases with required documentation	20	20	19	19	20	18
Adherence to national guideline (%)	95	95	90	90	95	86
Aim % adherence to national guideline	100	100	100	100	100	100

Key points

- Full documentation of neuromuscular status in paediatric supracondylar fractures of the humerus is vital to allow for effective preoperative and postoperative further assessment.
- With the move into paperless documentation, online pro formas can help clinicians with effective assessment and documentation.
- It is no longer sufficient to use the term 'neurovascularly intact' when documenting for injuries that can impair function.

remained the worst area, but this had improved by 76% in 1 year. The other areas were also dramatically improved, suggesting that the message was well received by the audience, and colleagues understood the importance of this change.

Improved adherence to guidelines correlated with improved use of the pro forma. The authors suggest that this is largely because of the prompts for examination and documentation that are included within it. New doctors in the department have commented on how useful it is to have such a tool. The pro forma not only acts as an aid for adherence to clinical guidelines, but as an educational tool and discussion topic for on-call case-based discussions.

The authors acknowledge that pro formas can be seen as extra paperwork, and hassle for doctors who are already busy in their job. However, as this pro forma was added to an electronic patient record, was easily accessible, and was restricted to this specific patient set, it was seen as an effective tool. This confidence in and acceptance of a new way of working undoubtedly contributed to the results.

As the hospital continues to transition to paperless notes, the authors will continue to audit the effectiveness of the pro forma, and adherence to this important national guidance.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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Appendix 1. Clerking pro forma for patients with supracondylar fractures of the humerus

Tabs in blue will reveal drop-down menus within the operating programme with options as detailed at the end of the pro forma for your information

Orthopaedic Review ? SCH # - SHO on call X

Consultant On call

(Age) M/F w/PC: L/R SCH # X˅

HPC

Fall from [X] X

Last meal X

Clear fluids X

Bg

Now

D/W SpR C

Allergies: X

XR:

O/E

R- M: X˅	Paper + S : X˅	(Thumb webspace)
U- M: X˅	Scissors + S: X˅	(Little finger)
M- M: X˅	Rock + S: X˅	(Index finger)
AIN – M: X˅	OK	

Radial pulse: X˅

CRT: X sec

Imp

L/R SCH#

Grade: X

Plan

1 Flex arm >90° + POP AE Backslab

2 Re XR Post Backslab

3 D/W SpR/Consultant

4 Mark and consent and/or D/W CEPOD/Anaesthetist

5 Analgesia

6 MUA + KWire (if required)

7 Early light breakfast 0600

AE = above elbow; Bg = background; CEPOD = confidential enquiry into perioperative deaths; CRT = capillary refill time; D/w = discuss with; HPC = history of presenting complaint; m-ain = motor anterior interosseous nerve; m-m = median - motor; MUA = manipulation under anaesthesia; o/e = on examination; PC = presenting complaint; POP = plaster of Paris; r-m = radial - motor; SCH = supracondylar fracture of the humerus; SHO = senior house officer; SpR = specialist registrar; u-m = ulnar - motor; xr = X-ray; # = fracture