



# The Journal of Bone & Joint Surgery

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**Chairman:** Mr. Bijayendra Singh, Consultant.  
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## **Pink Pulseless Hand Following Supracondylar Fracture in Children - The optimum management Strategy**

The issue is very topical & continues to be debated. We reviewed five articles published over the last 15 years.

It was interesting to note that most of the studies suggested an aggressive approach for these injuries i.e. exploration of the brachial artery.

We will be taking this into account and talking to our vascular surgery colleagues.

## **Perfused, pulseless, and puzzling: a systematic review of vascular injuries in pediatric supracondylar humerus fractures and results of a POSNA questionnaire**

Lydia White et al.

J Pediatr Orthop 2010;30:328–335

### **Study design: Systemic Review**

**Reviewer:** Mr Nadeem Mushtaq, SpR South East Thames Orthopaedics

**Background to Study:** The treatment of paediatric supracondylar humerus fractures remains controversial in the presence of possible vascular compromise, and in particular with a “pink pulseless hand”.

The aims of this study were to determine the incidence of arterial injury in a pulseless supracondylar fracture. Secondly, to determine the opinion of Paediatric Orthopaedic Society of North America members regarding the incidence of vascular injury in such cases.

**Inclusion criteria:** all articles pertaining to pulseless supracondylar fractures

**Exclusion:** nil

### **Results:**

331 pulseless fractures: after closed reduction, the pulse did **not** return in 157 (47%) of which 129 (82%) had an arterial injury.

98 **Pink** and pulseless fractures: after closed reduction, the pulse did **not** return in 57 (58%) of which 40 (70%) had an arterial injury.

Surgeons underestimated arterial injury by a factor of 4x in a pink pulseless hand (70% v 17%).

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**Strengths:**

- Well designed and executed study
- Large numbers of patients
- Clear inclusion and exclusion criteria
- strong endpoint

**Weaknesses:**

- Inclusion heterogeneous descriptions for “perfused”, “pulseless”
- Publication bias of studies selected. Interventional studies more likely to be published

**Will study change clinical practice:**

Yes. More aggressive approach to pink pulseless hand.

**Vascular injuries and their sequelae in paediatric supracondylar humeral fractures: toward a goal of prevention.**

Copley et al.

J Ped Orthop 1996;16:99-103.

**Reviewer:** Mr. V Raghu Prasad, Senior Clinical Fellow.

**Background:**

The presentation of a child with displaced Supracondylar Humerus fracture with associated vascular compromise is not unusual. The approach /evidence in identifying /addressing the vascular injuries is varied though there seems to be no ambiguity in immediate fixation of bony injury itself.

**Aim of the study:**

To study the significance of an absent or diminished radial pulse to the clinical decision process and ultimate outcome was studied toward a goal of prevention.

**Method:**

This was a case series looking at 128 type supracondylar humeral fractures presented to this institute between 1988-1994. History, Physical Examination, Radiologic studies and treatment were reviewed in addition to demographics, type of admission.

The vascular status is classified as three different types: palpable, diminished and absent.

Mechanism of injury as high and low energy.

Those patients who had been noted on initial examination to have absent or diminished pulses were called to determine if any residual effects of vascular injury were present ( cold intolerance, functional differences ).

**Results:**

A total of 128 patients presented with Gartland type3 fracture. Of these 111 had normal and 17 abnormal vascular examination. All 17 patients had ‘immediate’ CRPP and vascular status was assessed in theatre. Of the 17, there was no pulse in 3 and all the 3 patients underwent immediate exploration, repair or bypass under same anaesthetic. Two among the 14 with pulse post CRPP lost their pulse over 24-36 hours.

All 5 children with vascular injuries had pre-operative warning signs with at least presence of 3 of the 5 ‘P’s of vascular compromise.

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Compartment pressures were measured in 6 and only one was determined to have compartment syndrome clinically and went on to have fasciotomies.

Four patients had angiography of these two were on table angiograms and it was not considered to have altered the course of management.

### **Discussion:**

The presence of absent or diminished arterial pulse was 100% sensitive for detecting vascular injuries and this was considered one of the early sign to be concerned about. The five 'P's of ischemia were felt to be late indicators of vascular compromise and was not always possible to distinguish from muscular or fracture pain in this age group. Other possible indicators to raise suspicion of vascular injury are " high energy injury, postero-lateral displacement and ecchymosis. Angiography was not the deciding factor in their series.

Towards the aim of their study the following principles of evaluation and management has been recommended:

1. Careful History and examination looking for clinical signs of vascular insufficiency
2. Immediate CRPP with absent & diminished pulses followed by careful assessment. If diminished perfusion is suspected on table advised to allow 30 minutes for arterial spasm to settle if still in doubt to proceed with exploration under 'same' anaesthesia
3. Careful assessment of compartment pressures and timely fasciotomies.

### **Strengths:**

1. Reasonable sample size
2. Algorithm followed / to follow is logical

### **Weakness:**

1. ? retrospective /? Prospective
2. level of evidence III
3. statistics - poor
4. presentation of study – rather confusing & repetitive

### **Will study change my clinical practice:**

#### **Possibly,**

1. on table will give a 30 minute interval post fixation – allow this time for logistic management ( specialists, equipment etc etc)
2. post-operatively duration of stay / observation – to a minimum of 24 hour stay

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**The 'pulseless pink' hand after supracondylar fracture of the humerus in children. The predictive value of nerve palsy**

Mangat, K.S., Martin, A.G., Bache, C.E.

J Bone Joint Surg [Br] 2009; 91-B:1521-5.

**Reviewer:** Rajesh Bawale, Senior Clinical Fellow.**Summary:**

The aim of this study was to compare the two different approaches to the management of the pink pulseless hand after a displaced supracondylar fracture Gartland Extension type III with posterolateral displacement in children. This is a retrospective case series of 19 patients since 1995 at one hospital. These patients were divided into two groups, Group I contained 11 patients ( 5 patients had neurological deficit ) treated with closed reduction and observed. Group II contained 8 patients who underwent immediate exploration.

Four patients in Group I needed secondary surgical exploration.

6 patients had brachial artery tethering and 4 patients had nerve involvement.

9 out of 19 patients had neurological involvement (47%)

7 out of 19 patients had brachial artery tethering (38%).

Authors recommended early exploration of the vessel in presence of anterior interosseous or median nerve palsy.

**Study strengths:**

1. Good number of case series.
2. Types of procedures, post-op care, inclusion criteria well defined.
3. The results and the discussion are well described.

**Study weaknesses:**

1. Level IV evidence
2. Inadequate information about the follow-up and the exclusion criteria.

**Relevance:**

The main aim of this study was well proven, as to establish the preferred method of pulseless pink hand with nerve involvement early exploration of the vessel. As described in this study 7 out of 9 (with neurological deficit) patients showed brachial artery involvement which supports the author's recommendation.

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**Management of pulseless pink hand in paediatric supracondylar fractures of humerus.**

Sabharwal et al

J Paediatr Orthop 1997;17: 303-10.

**Reviewer:** Mr Paras Mohanlal, Registrar**Objectives:**

To use non-invasive imaging techniques to determine outcome and brachial artery patency rates in children who had surgical procedures to re-establish radial pulse after type 3 supracondylar fractures of the humerus

**Materials and Methods:**

It was a retrospective study drawn from 410 patients with supracondylar fractures treated at British Columbia's Children's Hospital in Vancouver from January 1984 to September 1992. Of this sample, there were 13 patients with extension type 3 supracondylar fractures with a pulseless pink hand. Twelve were closed and one open injury. Seven patients had evidence of neurological deficit.

An initial attempt at closed reduction and k wire fixation was attempted in all patients. An angiogram was done if no radial pulse was detected after 8 hours and then depending on the findings thrombolysis, vein angioplasty, thrombectomy or end to end anastomosis was done.

**Results:**

With an average follow-up of 31 months (1-94), all patients had a palpable radial pulse with no signs of cold intolerance, exercise induced ischemia or growth disturbance. All 7 cases of neuropraxia improved. MR angiogram performed in 10 patients revealed patent brachial artery in only 5 patients.

**Conclusion:**

Early revascularization of pulseless, but well perfused hand in children with type 3 supracondylar fractures, although safe and feasible is associated with high rate of asymptomatic re-occlusion and stenosis of brachial artery.

**Strengths:**

- Relevant and useful to current practice.
- The subgroup of patients is drawn from a large series.
- Good follow-up and documentation of complications.

**Weaknesses:**

- Retrospective
- Non-randomised
- No mention of observer bias
- No mention of exploration of neural structures at the time of surgery
- No validated scoring system used

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**Ischaemia and the pink, pulseless hand complicating supracondylar fractures of the humerus in childhood: LONG - TERM FOLLOW-UP**

Blakey et al

J Bone Joint Surg [Br] 2009;91-B:1487-92.

**Reviewer:** Mr Nicholas McArthur, Senior Clinical Fellow**Summary**

A series of 26 children with a 'pink pulseless hand' following a supracondylar fracture of the distal humerus after a mean period of three months except for one referred after almost three years. They were followed up for a mean of 15.5 years. The neurovascular injuries and resulting impairment in function and salvage procedures were recorded.

Of the 26 fractures, 21 had been treated by operative fixation and five by manipulation and casting alone.

The flexor compartment was worst affected and palliative operations were necessary in 22 children. These included flexor muscle slide in 17, step elongation of the tendons in four, and a free functioning transfer of gastrocnemius in one.

Three of the four patients in whom the artery had been explored early did well with no evidence of postischaemic contracture.

**Strengths**

Long term follow up

Large case series

**Weaknesses**

Retrospective study

Selection bias

Exact time points of treatment are also not present

No detailed description of treatment of each child presented

No presentation of functional outcomes in the case series

No hard explanation of recommendations in the discussion relating to their results

**Learning points**

The pink, pulseless hand complicating supracondylar fractures can lead to long term reduction of forearm function