

An economic and Universal Tool, For Paediatric Hip Spica Application and Supracondylar Humerus Fracture Reduction: Technical Note

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ABSTRACT

Introduction: Application of a hip spica and closed reduction of supracondylar humerus fractures are two of the most common procedures, done in paediatric orthopaedics. We introduce an economical and universally available tool, to simplify application of the hip spica and aid in the closed reduction of supracondylar humerus fractures in any orthopaedic setup.

Methods: Our tool was used, in the application of 30 hip spica's and in 14 closed reduction and percutaneous pinning of supracondylar humerus fractures.

Conclusion: our tool is portable, requires no fabrication and is easily procured. It is an effective aid, in hip spica application and supracondylar humerus fracture reduction.

1. INTRODUCTION

The technique of effective hip spica application is an imperative skill of a Paediatric Orthopaedic surgeon. A hip spica is, either a primary essential or an adjunctive in the treatment of various conditions like- femur fracture in young children, proximal femur osteotomy, septic arthritis of the hip and developmental dysplasia of the hip (DDH). [1] Most recommendations, for the positioning, for a hip spica application include, either a spica table or fabrication of an assembly. Both of which are either unavailable or cumbersome to construct, in most orthopaedic setups in India.

Supracondylar humeral fracture (SCH) is the most common elbow fracture in children. At present, the standard of care for the management of Types 2 and 3 displaced fractures is closed reduction percutaneous pinning (CRPP). Literature is inundated with techniques, for closed reduction of this injury. Both Femur fractures and supracondylar humerus fractures together comprise an estimated 25% of all paediatric injuries. Approximately 32% of femur fractures occur below 6 years of age, which necessitates application of a hip spica for management.[2] Approximately 40% of SCH are treated operatively making it the most common paediatric fracture to undergo operative treatment. [3]

We introduce a simple, economical and universally available tool, which can be used, for both, application of hip spica and closed reduction of supracondylar humerus fractures.

2. MATERIALS AND METHODS

The tool

The tool is a simple, universally available plank of wood (silver oak wood) of dimensions 100cm * 5cm and of thickness 1cm. We, purchased two such planks. This (material) is easy to procure commercially and costs approximately Rs 50 for a single plank. A single plank is used, in reduction of supracondylar humerus fractures and in spica application for infants below 2 to 3 years of age. Two planks are used beside each other, for spica application, for older children.

Setup and application of hip spica.

Positioning One or two boards are selected, based on the patient's age and size. The OT table height is adjusted such that the board is flat and level to the nursing trolley The board is positioned at the head end of the table, close to the anaesthetist and

their workstation. Such that, $\frac{1}{4}$ th of its length is on the OT table and below the patient and $\frac{1}{4}$ th of the length rests on the nursing trolley (figure-1). To position, the patient is held on both sides firmly, with one hand below the pelvis and the other holding the femur. The anaesthetist, at the head end, stabilises the airway and head, then gives the count, to shift the patient 90 degrees. Such that the patient's head and chest up to nipple is resting on the plank on the table and the rest of the patient is positioned free on the plank.

Figure 1: The plank dimensions, OT setup scheme, spica being applied to a patient.

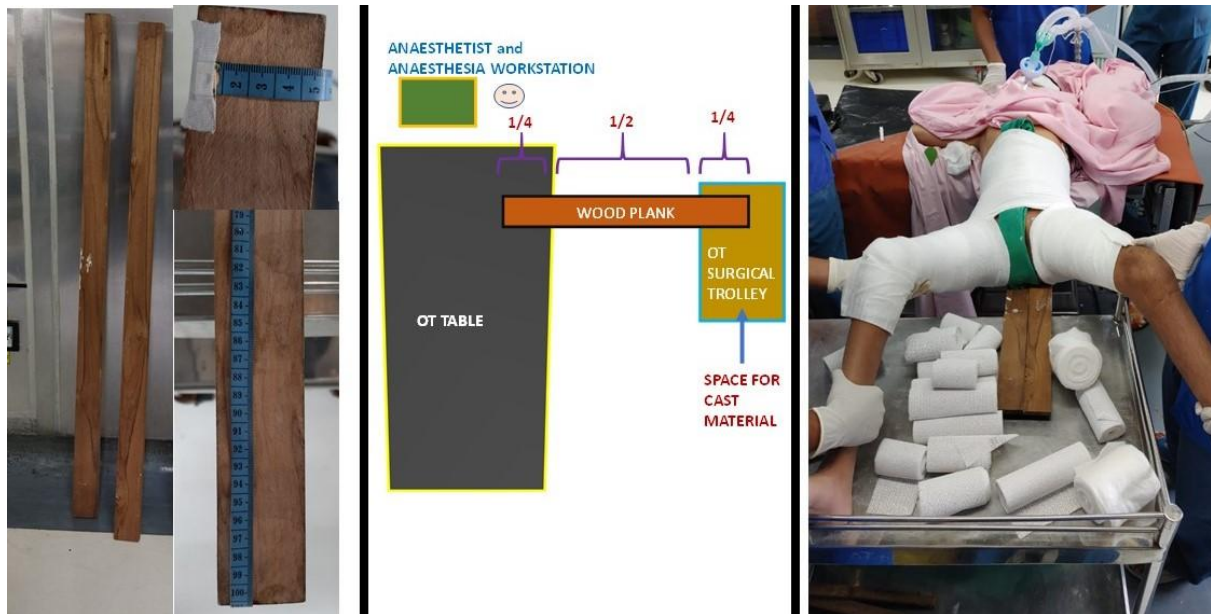


Figure 2: OT setup for SCH pinning, patient and plank position, arm position and board strapping.



Application We applied a hybrid spica in all the cases. A single assistant is sufficient to hold the lower limbs of the patient in the desired position. A bigger child, will need two, one assistant for each limb. The spica casting technique, we followed is based on those suggested by Bitar K M et al and S J kumar. [1,4] We applied a connecting bar for all the spica's. Once the spica application was completed, the child is then shifted on to the OT table, then, the board and abdominal towel are slid out. The presence of the bar and abdominal towel, creates space for expansion of abdomen and no window is needed for the spica.[5]

Setup for supracondylar humerus fracture reduction and pinning

Over the past 2 years, we have used the 'Arm board technique' described and demonstrated in video by Sodhai VM et al. [6] Under general anaesthesia, the patient is positioned supine with the affected limb abducted to 90°. The OT table is positioned,

with the foot end angulated about 30 degrees to the head end. The board is slid under the affected arm, under the upper back of the patient. The arm is positioned on the wooden board and is adjusted to support the arm proximal to the fracture site. The proximal arm is fixed to the board with a broad hypoallergenic adhesive tape to stabilize the proximal fragment, i.e., proximal to the fracture site. The elbow and the distal part of the limb are completely free for reduction manoeuvre and pinning. The image intensifier is positioned parallel to the foot end of the table (which is angulated) on the same side as the injured limb and surgeon while the monitor is positioned on the contralateral side opposite the surgeon for easy viewing.

The elbow is extended and C-arm used to check fracture configuration. Standard reduction manoeuvres are employed. There is no need for assisted countertraction because the proximal limb segment is strapped firmly to the board. Varus and valgus malalignment, mediolateral translation, as well as rotational displacements are easily corrected as the proximal segment is fixed and manipulation of the distal fragment to align with proximal. The reduction is confirmed on both AP and LAT views, without moving the limb. The limb is held in this position, prepared, draped and percutaneous k-wires applied according to standard protocols. The limb is then immobilised in a above elbow slab.

3. RESULTS

The tool was used, over the past 2 years, to apply 30 hip spica's to 18 children, by a single surgeon. The oldest child was aged 11years and the heaviest child weighed 38 kgs. There has been no mechanical failure of the tool, during spica application.

The tool was used according to the technique described by Sodhai VM et al, by a single surgeon, to treat SCH. We could achieve an acceptable closed reduction in all 14 cases and pinning done percutaneously. The average operating time, with the learning curve, reduced significantly.

Table-1 Hip spica application

Sl no.	Age	sex	diagnosis	No. of spica applied	weight
1	3Y 6M	F	B/L DDH	3	15 kg
2	10m	F	RT FEMUR SHAFT FRACTURE	1	6 kg
3	11Y 3M	F	RT DDH	1	22 kg
4	6Y 7M	M	RT FEMUR SHAFT FRACTURE	1	18 kg
5	11M	F	RT DDH	2	6 kg
6	10Y 2M	F	RT DDH	2	38 kg
7	1Y 7M	M	OGI WITH LT FEMUR SHAFT FRACTURE	1	6 kg
8	9Y 2M	F	RT NECK OF FEMUR FRACTURE	1	22 kg
9	4Y 5M	M	LT DDH	2	19 kg
10	1Y 4M	F	LT DDH	2	8 kg
11	4M	F	B/L DDH	2	4 kg
12	11Y 2M	F	B/L DDH	3	29 kg
13	2Y 1M	M	LT FEMUR SHAFT FRACTURE	1	11 kg
14	4Y 3M	M	RT DDH	2	15 kg
15	2Y 7M	F	RT PROXIMAL FEMUR FRACTURE	1	11 kg
16	2Y 4M	M	RT FEMUR SHAFT FRACTURE	1	11 kg
17	10Y 2M	F	B/L DDH	3	35 kg
18	11y	F	RT FEMUR SHAFT FRACTURE	1	14 kg

Table-2 Arm board technique for SCH

SL no.	AGE	SEX	DIAGNOSIS (MODIFIED GARTLAND)	PROCEDURE	OT time
1	6Y 8M	M	LT SCH TYPE-3	CRPP	50
2	14Y 2M	M	RT SCH TYPE-3	CRPP	60
3	5Y 6M	F	RT SCH TYPE-3	CRPP	40
4	11Y 2M	F	RT SCH TYPE-2	CRPP	40
5	1Y 1M	M	RT SCH TYPE-4	CRPP	50
6	7Y 11M	M	LT SCH TYPE-3	CRPP	45
7	11Y 4M	M	LT SCH TYPE-3	CRPP	70
8	3Y 10M	M	RT SCH TYPE-3	CRPP	30
9	7Y 4 M	M	LT SCH TYPE-3	CRPP	30
10	8Y 2M	F	LT SCH TYPE-4	CRPP	30
11	5Y 9M	M	RT SCH TYPE-3	CRPP	30
12	5Y 10M	F	RT SCH TYPE-2	CRPP	30
13	6Y 4MF	F	RT SCH TYPE-2	CRPP	25
14	1Y 2M	F	RT SCH TYPE-4	CRPP	30

4. DISCUSSION

Literature gives us two broad approaches, to apply a hip spica. One, using a spica table, its associated variations of methodology and two, alternatives to the spica table. Yaniv keren et al, gave us the lotus position for casting using a spica table. [7] IPS Gill et al, introduced a box and bar apparatus. [5] The alternatives to a spica table include, using cushions as described by Benjamin Joseph et al [8] ; OT table arm board, described by Charles B. Pasque, [9] and a hammock apparatus to apply hip spica as elucidated by Keith E fraser [10]

Paediatric Orthopaedicians are on a constant vigil to simplify the apparatus and the process of spica application. Our tool is a convenient replacement, as very few institutions can justify the cost of a spica table. It requires no fabrication; the technique is simple and is well accepted by the anaesthetists as the displacement of the child, is minimal at the head end.

The arm-board technique for paediatric SCH, is well described by Sodhai V M et al. [6] The mechanical support to the proximal fragment, makes the process of reduction in all planes, easier. We have found that, it makes C-arm imaging and positioning convenient. By sliding the C-arm to support the forearm, it facilitates the conversion to Open reduction, if needed.

5. CONCLUSION

Our tool requires no fabrication, is economical and universally procured. This low-tech tool is portable and has a short learning curve to efficiently apply hip spica and manage Paediatric supracondylar humerus fractures.

6. CLINICAL MESSAGE

Technique of application of hip spica and reduction of supracondylar humerus fractures using the plank reduces operative time, is of low cost and is easily procurable. The usage of this appliance makes both procedures significantly easier than various other methods described. Hence this tool is clinically very relevant especially in low cost peripheral and rural setups.

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