

# Pre-hospital Management of the Fractured Femur Using the Tauranga Thomas Splint

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## SUMMARY

Two aspects of the early management of the fractured femur are discussed: firstly the immediate treatment in the pre-hospital phase and secondly the transportation of this injury case over a long distance where necessary. In both instances there is considerable room for improvement, and this is discussed, particularly with relation to splinting techniques.

*S. Afr. Med. J.*, 48, 835 (1974).

The immediate treatment of the fractured femur in South Africa following a motor or other accident is usually carried out by ambulance personnel or others trained in first-aid techniques. This treatment is usually not optimal because the standard of training of the personnel varies from good to none in certain areas and because there was, until recently, no effective emergency splint for these cases.

The transportation of a patient with a fractured femur over long distances from a country hospital to a regional hospital for definitive treatment is common practice. These patients, who may have other injuries, usually receive treatment from the local practitioner before transportation and resuscitation have been initiated. In spite of this, cases admitted to the regional hospital are often in a far from satisfactory condition. There are multiple contributory causes, among them the following:

- (a) The nature of the concomitant injuries may be such that no marked improvement in condition will occur until definitive therapy has been carried out.
- (b) Resuscitation is often not adequate because of insufficient fluid replacement. This is partly owing to the fact that most country ambulances do not have sufficient interior height to permit intravenous therapy to operate effectively, and because the practitioner concerned does not secure the cannula with the movement of the ambulance taken into account. The result is non-operative intravenous therapy and a fluid backlog.
- (c) The involved limb is not adequately splinted to ensure total immobilisation and relief of pain in the back of a jolting ambulance. This again is partly owing to the practical unavailability of suitable splints.

In both the immediate pre-hospital treatment and the later transport of the patient there is the common factor of inadequate splinting, and I shall confine further discussion to this aspect. As pointed out by McMurray,<sup>1</sup> the originator Thomas himself conceived most possible modifications to his splint and, finding that they offered no significant improvement, discarded them. It should be borne in mind, however, that in 1866 many materials we have today were unknown, and for this reason it was considered worth while to examine a further modification of Thomas's original design, carried out by a New Zealand group,<sup>2</sup> in the hope that a solution would be found to the problem under discussion. This splint was taken on trial by the mobile accident unit of our hospital in conjunction with the local ambulance service. It has now been in use for 1 year.

## FEMUR SPLINTS

Requirements for the splint during the pre-hospital phase and for use during transport were determined to be as follows:

### Pre-hospital Phase

The splint should be effective in terms of immobilisation of the limb and for relief of pain and subsequent shock. Effective splinting is required even when a comparatively short trip is involved, in view of further injury and pain likely to occur during a bumpy ambulance ride. The splint should be easy to apply, with minimal patient discomfort. It must be rapidly applicable, by one man if necessary. It must be usable under all weather conditions, without difficulty or discomfort to patient or ambulance crew. It must be simple and adaptable to various sizes and both sides of the leg. It should be compact for storage purposes. It should not interfere with existing ambulance trolleys. It should be suitably stable and radiotranslucent to permit the patient to remain in the splint until definitive therapy. It should be inexpensive.

### Transport

For transportation of the patient many of the above criteria for splints are desirable but not mandatory as, generally speaking, better conditions and more time are available.

Unfortunately, a country practitioner seldom sees a splint again once the patient is dispatched to a busy regional hospital. The chief reasons for this are the

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lack of interchangeable splints and the haste involved in dealing with such cases. In a small hospital it is not possible to stock a large range of splints on the off-chance that they may be required.

### Splinting Techniques Currently Available

**Tying the legs together:** This is not effective in terms of immobilisation or pain relief in a jolting ambulance.

**Wooden or hardboard splints:** These are widely used but to be effective a back splint must be employed in addition to the two side splints. This application of three splints simultaneously is difficult and painful.

**Cardboard or bamboo strip splints:** Immobilisation is excellent but pain relief is not sustained, owing to lack of traction. Traction alone provides continued pain relief in a fractured femur.

**Pneumatic splints:** Again excellent immobilisation and even pain relief are achieved, but there are potential disadvantages. Blood flow may be further impaired where already prejudiced owing to the injury or pre-existing arterial disease. There is conceivably an increase of tissue pressure, one of the factors involved in fat embolism according to the mechanical theory.

**Thomas splint and half-Thomas modification:** The Thomas splint principle is undoubtedly correct, but practical disadvantages lie in the difficulty of application and the vast range of sizes and fittings required. The modification is an attempt at universality but it is not mechanically possible to effect adequate traction with an ill-fitting half-ring.

**The Tauranga Thomas rescue splint<sup>2</sup>** (the new modified Thomas splint): The Tauranga splint as originally described, came in two forms, the hospital and rescue types. It is the latter with which we are concerned. This original modification is now available in South Africa. Perhaps the most striking feature of the splint is its size. When not in use it makes up a package  $42 \times 24 \times 5$  cm and mass 1 kg.



Fig. 1. Comparative size of packaged splint and 1-litre infusion bottle.

The splint is universal insofar as it fits the left or right leg in all sizes down to a child of about 8 years of age. When assembled it is a classical Thomas splint, which undoubtedly is still the method of choice for emergency treatment and transport of the fractured femur.

The small packaged form is achieved because the splint is assembled from a number of components, consisting firstly of a malleable ring opening anteriorly, with Velcro strips on opposing surfaces to complete the ring to the desired size. The side arms are made up of aluminium members which interlock neatly and are joined distally by a U-piece with adjustable butterfly nuts, allowing accommodation for left or right legs. The splint is completed by means of a Millbank boot clip with elasticised cord for traction (Figs 2 and 3).



Fig. 2. The fully-assembled splint.

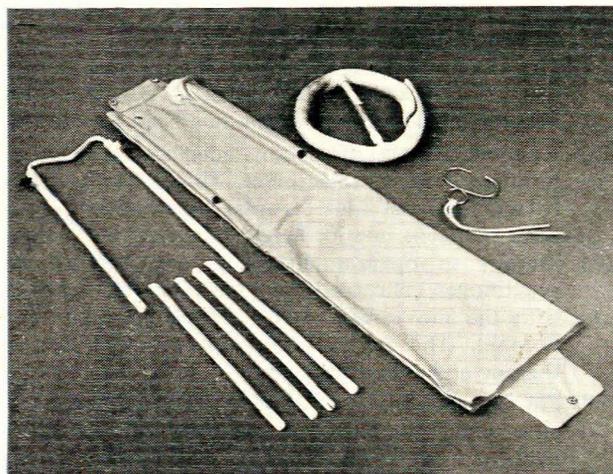


Fig. 3. Component parts of splint as supplied.

The special advantages of this splint lie in its application, which proves it to be more than just a collapsible Thomas splint.

## APPLICATION OF THE TAURANGA SPLINT

For the purpose of the trial the method of application was standardised. It was more effective to assemble the splint around the limb than to pre-assemble it. By placing the open ring into the gluteal groove and then adding the members and the distal U-piece it is possible to achieve the correct size and fitting without moving the limb from the position in which it was found. This has the obvious advantage that no pain or discomfort is caused to the patient during application. This precludes the use of a stocking-type back support as described originally, but applying this once the splint is in position is both difficult and painful. The advantage of assembling the splint around the limb outweighs the possible advantages of the stocking-type back support.

Once the splint is assembled the type of traction to be employed is decided on. It has been found advantageous to use the Millbank clip as much as possible. Skin traction is extremely time-consuming, difficult to apply in the presence of open fractures and leads to unnecessary exposure of the limb. The only indication for using this method was the presence of a concomitant fracture of the ankle or foot. In the absence of a shoe a figure-of-eight bandage was first applied to the foot to provide purchase for the clip.

After assembly of the splint and application of the clip slow manual traction was applied and fixed in the traditional manner. This was the first and last time the limb was moved and was not unduly painful. Except where contra-indicated, Entonox gas is used by the mobile accident squad and this eliminates all pain associated with the immobilisation.

Only at this stage was back support applied to the limb. This was done by using flannel strips which are applied in the region of the popliteal fossa and then slid up and down the splint as required. This was entirely satisfactory in principle but the use of Velcro-faced strips would have been an improvement. These strips are not supplied with the splint.

The distributors suggest that the carrying bag should be used as a back support but this is totally unsuitable as it is of fixed size (being of non-stretch material) and requires pre-assembly of the splint.

The splint was found to be completely satisfactory in use and the entire application could be achieved by one man with little previous practice within 4 minutes.

Disadvantages were minor and include the following: the provision of some practical form of back support for the limb would make the package complete. The elasticised cord attached to the Millbank clip is not a good idea as it is practically impossible to unknot after use and more controlled traction can be applied by use of ordinary orthopaedic cord. The malleable ring stains very easily and is practically impossible to clean after blood-soiling. The Velcro strips of the malleable ring should be extended by a further 5 cm to provide better adhesion when the ring is in its smallest size.

## CONCLUSIONS

We have satisfied ourselves that this splint is functionally superior to any existing splint for emergency treatment of the fractured femur, in terms of ease and rapidity of application as well as patient comfort.

The effectiveness of the principle of the Thomas splint is not in question. Further advantages lie in its small size and its universality which allows free use by all country hospitals and on an exchange basis with regional hospitals. It may also be used as an effective temporary splint in the casualty department for patients awaiting X-ray examination or theatre procedures. Advantages to rescue organisations, such as mountain clubs, are obvious.

The costs are such that it may be used in all ambulances and the occasional loss of a splint would not be too costly.

## REFERENCES

1. McMurray, T. P. (1946): *Brit. Med. J.*, **1**, 872.
2. Gillon, D. J., Wilson, H. B. C. and Short, D. P. (1970): *N. Z. Med. J.*, **71**, 299.