

Venous thromboembolism during hip plaster cast immobilisation: Review of the literature

M.C. Struijk-Mulder^{1*}, H.B. Ettema¹, R.A.J. Heyne², J.J. Rondhuis¹, H.R. Büller³, C.C.P.M. Verheyen¹

¹Department of Orthopaedic Surgery and Traumatology, Isala Clinics, Zwolle, the Netherlands, ²Department of Pulmonology, Ziekenhuis Rivierenland, Tiel, the Netherlands, ³Department of Vascular Medicine, Academic Medical Centre, Amsterdam, the Netherlands, *corresponding author: tel.: +31 (0)38-4244482, fax: +31 (0)38-4243220, e-mail: mcstruijk@gmail.com

ABSTRACT

Introduction: There is a paucity of data regarding the risk of deep vein thrombosis during hip plaster cast immobilisation. The purpose of this article was to review the available evidence regarding the incidence of symptomatic venous thromboembolism (VTE) during hip plaster cast immobilisation.

Methods and Materials: All papers describing hip plaster cast immobilisation published in the English literature retrieved from PubMed, EMBASE and the Cochrane database were reviewed. Articles regarding children, hip dysplasia, congenital hip dislocation and Legg-Calvé-Perthes were excluded. A total of three papers were available for analysis. We also describe a case of pulmonary embolism during hip cast immobilisation.

Results: The overall incidence of symptomatic VTE during hip plaster cast immobilisation was 0% in 343 patients. The incidence of symptomatic VTE in hip cast brace was 2.3% (range 0-3%).

Discussion: Our systematic review of the literature showed a paucity of data regarding the incidence of VTE during hip plaster cast immobilisation. We describe the first case of pulmonary embolism during hip plaster cast immobilisation. We recommend that patients who are fitted with a hip plaster cast should be routinely screened for additional risk factors. When risk factors are present, patients should be considered for pharmacological thromboprophylaxis.

KEYWORDS

Plaster cast, pulmonary embolism, spondylodesis, venous thromboembolism, systematic review

What was known on this topic?

Immobilisation is a major risk factor for VTE. A meta-analysis on lower leg plaster cast immobilisation showed a highly significant and clinically relevant reduction in asymptomatic events with LMWH prophylaxis compared with placebo or untreated controls.

What does this add?

A systematic paper review on the incidence of symptomatic VTE during hip plaster cast immobilisation is presented. The first case of pulmonary embolism during hip plaster cast immobilisation is described. We recommend that patients who are fitted with a hip plaster cast should be routinely screened for additional VTE risk factors. When risk factors are present, patients should be considered for pharmacological thromboprophylaxis.

INTRODUCTION

There is a paucity of data regarding the risk of deep vein thrombosis during hip plaster cast immobilisation. The purpose of this article was to review the available evidence regarding incidence of symptomatic venous thromboembolism (VTE) during hip plaster cast immobilisation.

Furthermore, we describe a case of pulmonary embolism in a hip plaster cast. To our knowledge, this has not been documented before. Clinicians should be aware of the risk of venous thromboembolism (VTE) when treating a patient with plaster cast immobilisation. A meta-analysis

reported a mean rate of VTE during *lower leg* plaster cast immobilisation without thromboprophylaxis of 17.1%.¹

MATERIAL AND METHODS

A systemic search strategy was used to identify all papers describing symptomatic venous thromboembolism (deep venous thrombosis and pulmonary embolism) during hip cast immobilisation published in English before October 18th 2013. We used the PRISMA statement for systematic reviews.² We performed an electronic PubMed, Cochrane and EMBASE database search. The terms plaster cast or hip cast brace or pantaloons cast or spica cast were used. Articles regarding children, dysplasia, congenital hip dislocation, Legg-Calvé-Perthes and immobilisation with plaster cast restricted to the lower limb were excluded. From the retrieved articles, the reference lists were screened for any relevant papers. Full-text copies of these articles were obtained and assessed for eligibility. Articles which did not describe the type of cast or brace and articles concerning treatment with traction or prolonged bed rest prior to bracing were excluded. All papers selected were analysed for incidence of DVT and pulmonary embolism.

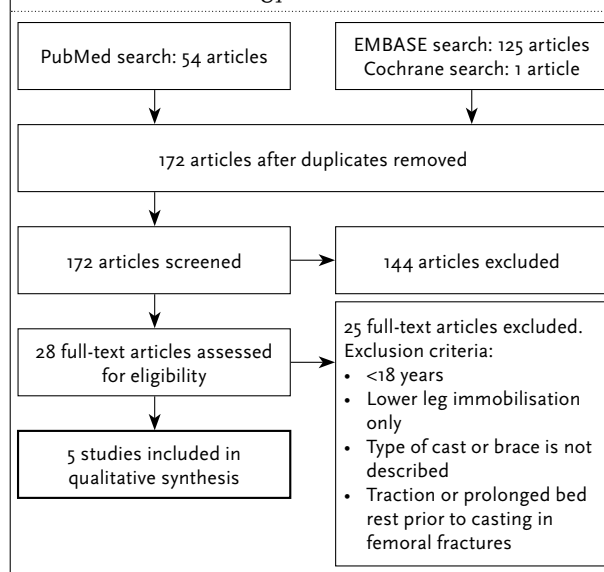
RESULTS

We reviewed 180 papers describing plaster cast immobilisation (*figure 1*). There were no randomised controlled trials or non-randomised comparative studies. Two review articles by the same author were identified.^{3,4} One article described the author's thesis, including the other review article. The systematic review included three studies with a hip plaster cast test for surgical decision-making in 120 patients with chronic low back pain.³ One of those three studies did not involve immobilisation of the hip. Rask *et al.* included 45 patients and the immobilisation period was four weeks initially and became two weeks later on.⁵ Markwalder *et al.* immobilised 25 patients for two weeks.⁶ In both studies, no VTE complications were described and the use of thromboprophylaxis was not reported.

Data of the review were supplemented by a prospective cohort study with 257 patients.³ Casts were applied for 3-6 weeks. The use of thromboprophylaxis was not described and no VTE complications were reported. It was concluded that in patients without prior spine surgery a hip plaster cast test with substantial pain relief suggests a favourable outcome of lumbar fusion compared with conservative management.

The third article of our search described a cohort of 67 patients with a hip cast brace after primary and revision hip replacement in order to prevent hip dislocation.⁷

Figure 1. Algorithm showing search method, according to PRISMA methodology



Two patients developed deep venous thrombosis. This brace allowed 70 degrees of flexion and a variable range of abduction in the hip joint, however. The hip cast in this case report is designed to immobilise the hip joint in a fixed 10 degrees of flexion. The purpose of this cast is to simulate lumbar fusion. The same type of soft-cast brace was applied in the fourth article to 21 patients, to conservatively treat hip dislocation for three months after total hip arthroplasty.⁸ No VTE was reported. The fifth article reported on 16 patients who were treated with a hip plaster cast for six weeks for dislocated total hip arthroplasty.⁹ Three patients underwent additional revision hip arthroplasty before the cast was applied. No thromboembolic complications were described. In summary, the overall incidence of symptomatic VTE during hip plaster cast immobilisation was 0%. The incidence of symptomatic VTE in hip cast brace was 2.3% (range 0-3%).

CASE REPORT

A 29-year-old woman with radiographically confirmed discopathy at level L4 to S1 was immobilised with a trial hip plaster cast immobilisation to simulate lumbosacral fusion. Pain relief would aid in the decision for lumbar fusion. The patient was on oral contraceptive medication (OCM) (ethinylestradiol 20 µg, desogestrel 150 µg). No other risk factors for the development of VTE were found. The patient's body mass index was 24. After 11 days of plaster cast immobilisation, the patient became dyspnoeic. Two days later, the cast was removed and the following day,

she presented to the emergency department with persistent dyspnoea and mid-sternal pain. There were no evident symptoms of deep venous thromboembolism of the legs. The diagnosis of pulmonary embolism was determined by means of a D-dimer of 15 mg/l in combination with multiple perfusion defects on a perfusion scan and confirmed by CT angiography, which showed a massive embolus in the right pulmonary artery and a central embolus in the left pulmonary artery. She was treated with low-molecular-weight heparin (LMWH) (nadroparin 5700 IE twice daily subcutaneously) and started with a vitamin K antagonist (VKA) (acenocoumarol). Once the international normalised ratio (INR) was between 2.5 and 3.5, the LMWH was discontinued and VKA was continued for three months. The patient was discharged home after 14 days in hospital. Two years later, a ventral spondylodesis at levels L4-S1 was performed.

DISCUSSION

Our systematic review of the literature did not show any symptomatic venous thromboembolic events during hip plaster cast immobilisation in 343 patients. Symptomatic DVT was reported in 2.3% (range 0-3%) of 88 patients immobilised with a hip brace.

The risk of VTE in patients with plaster cast immobilisation is not properly documented. A meta-analysis regarding six studies on lower leg plaster cast immobilisation showed a highly significant and clinically relevant reduction in asymptomatic events with LMWH prophylaxis compared with placebo or untreated controls (RR 0.58, CI 0.39-0.86, $p=0.006$).¹ The mean rate of VTE was reduced from 17.1 to 9.6% with the use of LMWH.

The authoritative American College of Chest Physicians (ACCP) guidelines give a grade 2C recommendation (based on low quality evidence) not to use pharmacological thromboprophylaxis in patients with isolated lower-leg injuries requiring leg immobilisation.¹⁰ They suggest that results from higher-risk populations may, however, be reasonably extrapolated to patients at higher risk of DVT (who were excluded from the studies), particularly those with prior VTE.

Several grading systems to identify risk factors for VTE have been developed, which are the subject of debate. Limitations of these risk assessment models include lack of prospective validation, applicability only to high-risk subgroups, inadequate follow-up time, and excessive complexity, according to the ninth ACCP guidelines regarding non-surgical patients.¹¹⁻¹⁴ To our knowledge, no clinical trials evaluating VTE prophylaxis for medical outpatients have yet been published.¹⁵

Generally, immobilisation is considered a major risk factor for VTE. In our case the immobilisation induced by the

hip plaster cast, combined with the use of OCM, puts our patient in the high-risk category.

Therefore we recommend that patients who are fitted with a hip plaster cast should be routinely screened for additional risk factors such as OCM use and a history of VTE. When risk factors are present, patients should be considered for pharmacological thromboprophylaxis.

Informed consent was obtained from the patient.

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