Elastic robust intramedullary nailing for forearm fracture in children

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Background
Forearm fractures are the most common fractures in children (23% of all fractures). In 2003 23,495 inpatient treatments in Germany were caused by a forearm fracture in children or adolescents. Prognosis and treatment decision depend on the doctors estimation of fracture instability. In general stable fractures can be managed by closed reduction and cast immobilisation (conservative therapy) with good prognosis for healing without complications. Instable forearm fractures are either completely displaced or show substantial tendency to shortening in cause of long transverse fractures. Aim of any fracture therapy is to stabilise these fractures to secure bone continuation and original length of the bone. In the past treatment option of first choice for instable forearm fractures has been conservative therapy. Main disadvantage of this therapy is the raised risk that the fracture ends could redislocate and a second or third reduction of the fracture will become necessary. After the development by Firica 1977 and Metaizeau 1984 ESIN became increasingly important as a therapy option for the treatment of forearm shaft fractures in children. It is expected that ESIN will provide a better position of the axis, better functional results, a decreased number of attempts of re-reduction and thus a reduced number of x-ray examinations. ESIN is an operational intervention performed under anaesthesia in the operating room. Treatment of forearm fractures with ESIN consists of ascending nailing of the radius and descending nailing of the ulna. Under anaesthesia the curved pins are introduced in the medullary canal. The correct position of the pins is checked by radiography. The pins realise a system of internal elastic contention, channelling the forces and preventing excessive displacement of the bone fragments. This technique has few complications and discharge from hospital is possible at the first day after surgery. The removal of the pins is executed after fracture consolidation

Objectives
Aim of this Health Technology Assessment (HTA) report is to assess and report the published evidence concerning effectiveness and cost-effectiveness of ESIN as a treatment option for diaphyseal forearm fractures in children and to identify future research need. Therefore this HTA report is divided into two major parts: (1) evaluation of medical effectiveness and (2) evaluation of cost-effectiveness. The following study questions are stated:

- Which differences between ESIN and conservative therapy can be determined with regard to the efficiency?
- What are the costs of ESIN and what are the costs of closed reduction and cast immobilisation?
- How is the cost-effectiveness of ESIN in comparison to different procedures of conservative therapy?
- Is it possible to identify further research need?

The ESIN is compared thereby against two alternative strategies:

- Conservative therapy in an outpatient setting
- Conservative therapy, accomplished in the operating room of a hospital in attendance to change to ESIN, in case that no stabilisation can be achieved with cast immobilisation.

Methods
An extensive, systematic literature search in the following medical, economic, and HTA literature databases was performed in January and July 2005. It was searched in the Cochrane Database of Systematic Reviews, in the Cochrane Central Register of Controlled Trials (CENTRAL), in Cochrane Database of Methodology Reviews, in the Database of Abstracts of Reviews of Effects (DARE), in the NHS Economic Evaluation Database (NHS EED) and in the Health Technology Assessment Database (INAHTA-Datenbank, HTA). Additionally there was a systematic search in the databases of DIMDI, that covers the following data bases: MEDLINE, MEDLINE Alert, EMBASE, EMBASE Alert, AMED, BIOSIS Previews, SCISEARCH, Meditec, CATFILEplus, Int. Health Technology Assessment, DAHTA data base, Cochrane Central Register of Controlled Trials, Cochrane Database base of Systematic Reviews, Health Device Sourcebase, Health Devices Alert, ÄZQ guidelines, German Medical Science, CCME, SOMED, GeroLit, Karger publishing database for full texts, Kluwer
Results

Three cohort studies have been identified that evaluate the effectiveness of ESIN compared to other treatment procedures. Additionally seven case series were found in the literature search. The studies examined instable, displaced fractures that could not be stabilised by conservative therapy. Controlled clinical studies, systematic reviews, and / or HTA reports that give information to answer the study questions of this HTA report could not be found. The identified studies partly differed in respect of defined indication for ESIN, study population and treatment strategies. For that reason comparability of results was limited. In the majority of cases the publications reported a successful consolidation of fractures treated with ESIN. The three cohort studies reveal that there is no difference regarding losses of motion when applying ESIN or conservative treatment. Publications that argue health-economic aspects of ESIN in children could not be identified in the literature search. A cost data assessment conducted by the authors of this report showed that ESIN is associated with higher costs compared to the other treatment strategies (without considering long term costs due to reduction in case of redisplacement).

Conclusions

Little evidence for a dominance of ESIN in treating forearm shaft fractures of children compared to conservative therapy could be found. With regard to losses of motion there is an advantage of ESIN in comparison to conservative therapy. Whereas an immediate stabilisation is achieved under primary treatment of a fracture with ESIN, there is the risk of non stabilisation when applying conservative therapy. Additional interventions will be necessary, which cause a burden for the patients and are cost-intensive. Accomplishment of ESIN without complications causes more costs than conservative therapy both in outpatient and in inpatient setting. Particularly with regard to patients’ perspective is further research need for studies that demonstrate the value of the technology concerning health-related quality of life.

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