



Review

Splenic function after angioembolization for splenic trauma in children and adults: A systematic review



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ABSTRACT

Purpose: Splenic artery embolization (SAE), proximal or distal, is becoming the standard of care for traumatic splenic injury. Theoretically the immunological function of the spleen may be preserved, but this has not yet been proven. A parameter for measuring the remaining splenic function must therefore be determined in order to decide whether or not vaccinations and/or antibiotic prophylaxis are necessary to prevent an overwhelming post-splenectomy infection (OPSI).

Methods: A systematic review of the literature was performed July 2015 by searching the Embase and Medline databases. Articles were eligible if they described at least two trauma patients and the subject was splenic function. Description of procedure and/or success rate of SAE was not necessary for inclusion. Two reviewers independently assessed the eligibility and the quality of the articles and performed the data extraction.

Results: Twelve studies were included, eleven with adult patients and one focusing on children. All studies used different parameters to assess splenic function. None of them reported a OPSI after splenic embolization. Eleven studies found a preserved splenic function after SAE, in both adults and children. *Conclusion:* All but one studies on the long term effects of SAE indicate a preserved splenic function. However, there is still no single parameter or test available which can demonstrate that unequivocally.

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Introduction

After blunt abdominal trauma the spleen is the most commonly injured organ. In 2013 242 people were admitted in the Netherlands to a hospital with a splenic rupture, with 83 being 18 years or younger [1]. For years splenectomy was the preferred treatment. The increasing knowledge of the immunological function of the spleen and the risk of an overwhelming postsplenectomy infection (OPSI) led to the introduction of spleen preserving techniques [2].

Currently, nonoperative management (NOM) is the most common management strategy in hemodynamically stable patients. Splenic artery embolization (SAE) is used in patients with an American Association for the Surgery of Trauma grade III to V splenic injury or active contrast blush on CT. Depending on the location of the rupture, peripheral splenic artery branch (partial) embolization and main splenic artery (total) embolization is possible. With a success rate of 90% or higher NOM is currently considered the standard of care [4–9].

The anatomy of the spleen contributes to its different functions. There are three layers, the white pulp, containing B-cell follicles, the marginal zone, containing specialized macrophages and memory B-cells, and the red pulp, where erythrocytes are filtered from the circulation. These different splenic functions are associated with different methods to determine the level of dysfunction of the organ [10]. The haematological function is measured by radionuclide tests such as scintigraphy and clearance of labelled erythrocytes, as well as the count of Howell Jolly bodies (HJB) and/or the number of pitted red blood cells. The immunological function of the spleen can be analyzed by determining the immune response upon vaccination or by evaluation of specific B-cell subsets [11].

Asplenic patients are at risk of OPSI, a complication with a high morbidity and mortality. Incidence is estimated at 2–5 per 1000 asplenic patients per year. Although most episodes occur within the first two years after splenectomy, the risk of OPSI is lifelong. The infection is reported to be fatal in 70% [12–14]. Encapsulated bacteria causing OPSI are *Streptococcus pneumoniae*, responsible of 70%, *Haemophilus influenzae type b* and *Neisseria meningitidis*. To prevent OPSI vaccination against these pathogens is required and in addition antibiotic prophylaxis is indicated for at least two years, depending on the age of the patient. However, guidelines are based on low-grade evidence, tend to vary, and patient adherence is often poor [15,16]. With antibiotic resistance as a worldwide problem, a careful selection of therapy is needed.

The primary aim of this systematic review was to assess if splenic function in children and adults after SAE is preserved. The second goal was to identify a parameter that can be used to measure splenic function after SAE.

Methods

A systematic search of literature was conducted to identify studies assessing splenic function in children and adults after SAE.

Data sources and search strategy

We searched the Medline and Embase databases for articles about splenic function after embolization (Notes 1 and 2 for detailed search). Additionally, the reference list of each eligible article was screened for other relevant publications (cross-reference). The search was performed in July 2015 and was conducted with the help of a clinical librarian.

Study selection

The selection procedure was performed by two independent reviewers (JS and LS). The inclusion criteria were: trauma patients; English or German language; original data (no review or editorials); randomized clinical trials, prospective or historical studies including at least two trauma patients; subject is splenic function, not procedure and/or success rate of SAE.

Meeting abstracts, unpublished data, and these were excluded. Both reviewers independently assessed the titles of the literature search to determine whether they were potentially relevant. Subsequently, the abstracts were assessed and the eligible articles were retrieved. The final step of inclusion was always based on the full-text article. Interviewer differences were resolved by discussion. During the selection process, no concealment of authors and institutions was used.

Data extraction

Data extraction was performed using a list for the following characteristics: number of patients, mean age at time of trauma, Injury Severity Score, time to follow-up, type of SAE (partial of total), received vaccination after SAE and the preservation of splenic function as concluded by the author.

Methodological quality

The methodological quality of the studies was assessed using a scale that was based on a checklist of the Dutch Cochrane Centre for evaluating cohort studies [17]. The scoring system consisted of the following eight items: description of demographic details of the investigated patient groups, description of the selection criteria for treatment, prospective study design, consecutive inclusion of patients, description of treatment, definition of splenic competence reported, a follow-up period of more than 6 months, and no selective loss to follow-up. If a study fulfilled the item, 1 point was awarded. If it was unclear whether the study fulfilled the item, no point was awarded. All items were assumed to be of equal importance and were not weighted. Studies with a score of 0–5 were classified as “poor quality” reports and those with a methodological score of 6–8 as “moderate to good.”

Risk of bias

The quality of included studies was assessed using the Newcastle–Ottawa scale [18]. The studies were assessed using 7 criteria: representativeness of exposed group, selection of control group, ascertainment of exposure, comparability of cohorts, description of excluded patients, assessment of outcome and adequacy of follow-up time. Studies with a score of 0–5 were classified as “poor quality” reports and those with a methodological score of 6–7 as “moderate to good.”

Results

The literature search resulted in 328 titles from the Medline database and 496 titles from the Embase database. After reviewing the titles 24 were selected for further evaluation. Based on the abstract 13 papers were excluded because they did not match the inclusion criteria resulting in 11 full text articles. Cross-reference added one additional paper, which made a total of 12 articles for full text review [19–30] (Fig. 1, Table 1). After quality assessment all studies were rated ‘moderate to good’ (Tables 2 and 3).

The aim of each study was to assess splenic function after embolization. All studies used different methods to measure

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