

Knee synovectomy in children with juvenile idiopathic arthritis

Synowektomia stawów kolanowych u dzieci chorych na młodzieńcze idiopatyczne zapalenie stawów

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Summary

An up-to-date opinion is provided on benefit-risk balance associated with various methods of treatment in children with idiopathic juvenile arthritis. The objective of this study was to assess long-term outcome of knee joint synovectomy in a group of patients with juvenile rheumatoid arthritis and to present the authors' view on this approach.

The authors concentrated on surgical methods which should allow painless rehabilitation and quick recovery of the correct knee function with good mobility. The challenge of providing anaesthesia for longer and more complex surgery in children with idiopathic juvenile arthritis is a reality.

In conclusion, we may say that knee synovectomy is an effective method for fighting effusion involving knee inflammation in JIA. It must be stressed however that results of the treatment strongly depend on the decision time and the advancement of the disease. According to our experience, we do not agree with the view of some authors that surgical intervention is not indicated until erosions are radiologically manifested; the state of low disease activity is also preferred for surgical intervention.

Juvenile rheumatoid arthritis (JRA) is a heterogeneous group of diseases in children, which are all characterized by arthritis in at least one joint for a minimum of 6 weeks duration. There has been an international change in the nomenclature to rename this group of diseases juvenile idiopathic arthritis (JIA) [1].

Streszczenie

Celem pracy było oszacowanie odległych rezultatów synowektomii stawów kolanowych u dzieci chorych na młodzieńcze idiopatyczne zapalenie stawów (MIZS). Uwagę skoncentrowano na metodach operacyjnych, które powinny umożliwić bezbolesną rehabilitację i uzyskanie szybkiej korekty funkcji stawu kolanowego, z pełnym zakresem ruchów. Realnym wyzwaniem było zastosowanie właściwej analgezji dla coraz bardziej długotrwałych i złożonych zabiegów operacyjnych. Na podstawie własnych obserwacji stwierdzono, że synowektomia jest efektywną metodą leczenia wysiękowego zapalenia stawów kolanowych w przebiegu MIZS. Należy podkreślić, że rezultaty leczenia są w dużym stopniu uzależnione od czasu podjęcia decyzji o zabiegu chirurgicznym oraz od progresji choroby. Decyzja o synowektomii może być podjęta we wczesnym okresie choroby, przed pojawieniem się nadżerek w obrazie radiologicznym, co stoi w sprzeczności z poglądem niektórych autorów.

According to the International League of Associations for Rheumatology (ILAR) classification criteria (Durban 1997) for juvenile idiopathic arthritis (JIA). JIA is categorized into main groups based on the number of joints involved during the first 6 months of disease and the involvement of other organs [2].

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- Oligoarthritis accounts for approximately 50% of JIA and is defined as involvement of up to 4 joints and high frequency of positive antinuclear antibodies. This type often includes uveitis (inflammation in the eyes).
- Polyarthritis – more than 5 joints are affected and usually it involves the large joints.
- Systemic arthritis accounts for approximately 10% to 20% of JIA and is characterized by high temperature, rash, and inflammation of other organs, in addition to arthritis. In contrast to polyarthritis, systemic arthritis is as frequent in boys as in girls [3].
- Enthesitis-related arthritis with lower limb, knee, and tarsal involvement also is associated with greater risk of developing sacroiliitis and occurs mainly in boys older than 8 years.
- JIA also includes psoriatic arthritis and spondyloarthropathies, which are not included in the spectrum of IRA.
- Undifferentiated arthritis group using the new classification (Edmonton 2001).

In comparison with the Durban JIA criteria the Edmonton criteria made the ILAR classification more transparent and easy to apply, but sometimes family history of psoriasis was responsible for most allocations to the undifferentiated arthritis category [4].

JIA comprises a group of painful conditions involving persistent swelling of the joints with variable presentation and course [5].

Although the cause of JIA is not known (it is idiopathic), it is likely the result of a combination of genetic, infectious, and environmental factors [6]. Regardless of the disease onset type, in the clinical image joint inflammation dominates, with such characteristic features as swelling, pain, effusion and limited mobility which lead to joint deformities, muscular atrophy and disability.

Morphological changes at the start of the disease are situated in the synovial membrane. Bone destruction is visible at later stages of the disease [7-9].

The frequency of arthritic changes situated in this joint is estimated as 65% of all patients and 82% of those starting with single-joint disease [8]. At the early stage, when the process of synovium proliferation is dominant, we observe hypertrophy of the synovial membrane in them, possibly accompanied by effusion and pain. Joint inflammation clinical features in JIA are the same as in other inflammatory states and are characterized by swelling, increased warmth, limited mobility and pain. With the development of the disease, flexion contraction follows, initially reversible, but if not treated, it leads to fixed contractures, both simple and complex.

Untreated flexion contraction leads to further deformities such as increasing valgus knee, outside shin rotation, and back tibia subluxation.

The treatment of JIA has improved in recent decades. Nonetheless, the treatment of an inflamed arthritic knee joint should begin as early as possible, from the appearance of clinical symptoms. The main goal of JIA therapy is to induce remission of the disease and prevent progression of joint damage.

The considerations are based on our observations of two hundred and fifty children with JIA. All of them were treated in the Institute of Rheumatology between 1990 and 2005.

In the initial phase of this inflammatory process, positive clinical results were achieved by addition of systemic anti-inflammatory agents and using various forms of physiotherapy; if no response was achieved, further, multiple intra-articular glucocorticoids were widely used. According to our observations an intra-articular application of betamethasone (dose 3.5-7 mg 3 times every four weeks) resulted in a very good clinical response and disease control at 2-3 years. The most common sites of injection were the knees. Children under the age of 7 were sedated with either midazolam or propofol. All other children received their joint injections under local anaesthesia. Our earlier observations had also shown that triamcinolone hexacetonide offers an advantage to triamcinolone acetate as it relieves inflammation and reduces pain and disability. The studies presented of the others have also confirmed our observations concerning the efficacy of triamcinolone hexacetonide [10-12]. However, the efficacy of betamethasone has turned out to be much higher than the others, with excellent clinical response in terms of pain, mobility and functional capacity over long periods of time.

Ultrasonography performed then can be very helpful in estimating the extent of the synovial membrane proliferation, the state of the joint cartilage and other internal joint structures such as tendons and meniscuses. It also serves to monitor both the inflammation process and the effectiveness of the therapy. The increasing expansion of the synovial membrane with accompanying intra-articular effusion is a recommendation to carry out chemical synovectomy (synoviorthesis). The condition for carrying out chemical synovectomy is effusion in the knee persisting for at least 6 months despite physiotherapy and local steroid therapy. After emptying the joint of the effusion fluid a drug is applied which leads to synovial membrane necrosis. Accompanying symptoms of joint swelling and increased body temperature disappear after a few days. Various preparations such

as osmic acid, rifamycin, Peroxinorm, Varicocid, Aethoxysklerol, and Radioisotope Y90 have been used for that purpose [6]. We observe that the results have been rated good to very good by 75% of the patients. Similar results were reported by Szymańska et al.; a satisfactory result after chemical synovectomy with osmic acid was obtained in about 70% of cases at five years [13].

The advantage of this method is its repeatability, which makes it possible to apply it several times in the same joint. There were no significant complications. It seems, in view of our experience, that chemical synovectomy is safe and gives great benefits to children with early JRA. Better results can be anticipated in those patients whose knees show little or no destruction radiographically and no significant deformity at the time of operation. However, beneficial results can occur even in those with more advanced changes. Even though the quality of the results tends to diminish with time, the procedure offers sufficient benefits to continue its use. According to our experience, in most cases diagnostic arthroscopy has been unnecessary before chemical synovectomy.

Nowadays good clinical results are achieved with radiosynovectomy based on the use of isotope Y90. It can be used as a primary method or in final treatment after surgical synovectomy. In that case we inject a colloidal solution of yttrium-90 citrate. Yttrium is a source of beta radiation, and therefore is harmless for humans, although radiological protection is necessary while applying it. This method can also be used 2-3 times if the initial dose is ineffective. Further expansion of the synovial membrane requires surgical treatment which involves approx. 15% of JIA patients. The first reports of JIA children treated with synovectomy date back to the previous century [14]. Also Polish doctors have participated significantly in the studies of this treatment [15, 16].

Orthopaedic surgery performed on children with juvenile rheumatoid arthritis (JRA) involves arthroscopy and arthrotomy. Rheumoorthopaedic surgery is performed on children who require arthroscopy and arthrotomy for drainage of inflamed joints and for surgical excision of the injured cartilage and ligament due to JRA.

The aim of surgical treatment is primarily elimination of pain, stopping destructive changes and maintaining functions of the joint. In the case of surgical knee synovectomy we consider its preventive role in the process of destructive joint change treatment in JIA children [17, 18, 19]. When scheduling a surgery for a child, we must plan it extremely carefully together with the rheumatologist,

rehabilitation specialist experienced in working with JIA children, and the child's parents. Detailed explanations must be given of the aim of the surgery and what difficulties it may involve. Close cooperation of the child and his parents with the medical team is the key to successful treatment. In treating children we follow the principle of surgery minimization, limiting it to soft tissues, the shortest possible immobilization, and early reintroduction of the functions of the operated joint.

It is possible to conduct the so-called open surgical synovectomy or with the use of arthroscopy [18, 19]. With current developments in the arthroscopic technique this method is highly advantageous in children. The reason is mainly less operation stress, less pain and much easier rehabilitation afterwards. Arthroscopic synovectomy is effective and safe but more burdensome and expensive than osmic acid or radiation synovectomy, and consequently deserves a place of choice in patients who have failed to respond to either of the last two methods [20].

According to our observations an arthroscopic synovectomy yielded results similar to open synovectomy, with less operative and postoperative morbidity. This technique allows for shortened hospitalization as this kind of surgery can be carried out in a one-day cycle. Postoperatively we use drugs for swelling decrease and analgesia. The patient undergoes intensive rehabilitation. The operated extremity should be immobilized and relieved for 6 weeks until a much less inflamed active synovial membrane grows back. In the so-called post-treatment isotopic synovectomy can be used. The so-called open synovectomy should be kept for the most advanced changes not responding to the treatment described above. The whole treatment process can be monitored with the use of ultrasonographic technology.

The pre-anaesthetic evaluation of an orthopaedic patient includes knowledge of the following patient information: medical history, present problems and estimation of the patient's condition with particular reference to heart and pulmonary function plus orthopaedic deformity and position of the patient during surgery. Synovitis of the temporomandibular joint cricoarytenoid and cervical spine (atlantoaxial subluxation) can make tracheal intubation extremely difficult [21]. The patient's mobility of these joints must be evaluated before the operation. The choice of anaesthesia for those operations depends on the child's age, his general condition and acceptable regional anaesthesia. Premedication with Dormicum is used for all children.

General anaesthesia with endotracheal intubation is indicated here if we cannot maintain a patent airway

by mask or if we consider the child too young for regional anaesthesia.

Several anaesthetic agents are available for this procedure. These include inhalation agents, non-depolarizing muscle relaxants and intravenous drugs.

We prefer using spinal to general anaesthesia particularly for children above 14 years old.

Spinal anaesthesia prevents intubation and provides good relaxation and prolonged postoperative pain relief, which in the case of using spinal morphine lasts about 24 hrs and sometimes longer. Spinal block is always induced with the children in the lateral decubitus position, which is more comfortable and safer for them. The needles used for spinal anaesthesia are similar to those used in adults except that they are shorter in length. Bupivacaine spinal heavy alone or in combination with opioids is recommended.

The frequent side effects include hypotension and symptoms following morphine such as pruritus and nausea. We did not observe respiratory depression associated with opioids. Nor did we find in our patients post-dural puncture headache, which can be associated with use of Sprotte needles and barbotage technique. During the operation we use Dormicum and when heavy sedation is needed low doses of propofol 0.5-1 mg/kg in single doses.

The contraindications for regional anaesthesia are identical to those for adults, but particularly for this group of patients, deformities in the spinal column which make it impossible to perform a smooth and atraumatic procedure are also among the contraindications.

Restriction of joint mobility necessitates careful positioning during the operation to minimize the risk of neurovascular compression. Blood loss is minimal because a tourniquet is used.

All patients are monitored closely in the post-operative ward for 24 hrs. Postoperative analgesia is provided by paracetamol and non-steroidal anti-inflammatory drugs (NSAID). If these drugs prove inadequate and/or pain worsens, opioids are added as required.

Children also need analgesics during rehabilitation just after the operation and treatment with both paracetamol and NSAID relieves pain. A recent study reported a correlation between reduction in circulating plasma β -endorphins and pain relief in patients treated with paracetamol, whereas rofecoxib did not do so [22]. That could explain why paracetamol is better tolerated by the children in many cases.

According to our experience the children do not need opioid to relieve postoperative pain after 48 hrs. We have had only a few children who complained of strong pain during exercise and required opioid therapy for successful rehabilitation.

The presented treatment is an effective method for fighting effusion involving knee inflammation in JIA. It must be stressed however that results of the treatment strongly depend on the decision time and the advancement of the disease. The best results are achieved in children at an early stage of disease development with single-joint arthritis [23].

It still seems, however, that this method of treatment, though safe and effective, is used too late.

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