Treating Children with Spinal Tuberculosis *via* Debridement with Allograft

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ABSTRACT

Objective: *This work aims to investigate the efficacy of debridement for paediatric thoracolumbar spinal tuberculosis (TB) by using the anterior approach and allogeneic bone graft.*
Methods: *The lesions of 16 children diagnosed with thoracolumbar spinal TB were exposed* via *the anterior approach. The pleura and peritoneum, granulation tissue, pus and dead bones with TB and the intervertebral disc with pathological changes and necrosis were completely removed. The anterior column of the spine was reconstructed using allogeneic bone graft from mothers ilium. The postoperative immobilization protection conferred by gypsum lasted from three to six months and the regular anti-TB treatment was given for more than a year.*
Results: *The follow-up procedure was completed within nine months to three years. All bone grafts of the 16 cases fused with no rejection, recurrence of pathology, deformity or paraplegia nor pseudarthrosis formation. The children had normal growth and development and were capable of living a normal life.*
Conclusion: *The lesions of spinal TB in children were removed* via *the anterior approach. The mothers' iliac bone was obtained to reconstruct the children's anterior spinal column, thereby inducing new bone formation without affecting the growth and development of the children. The efficacy of debridement was adequate.*

Keywords: Allograft, children, debridement, spinal tuberculosis

Tratamiento de Niños con Tuberculosis Espinal Mediante Desbridamiento con Aloinjerto

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RESUMEN

Objetivo: *El presenta trabajo tiene por objeto investigar la eficacia del desbridamiento en la tuberculosis (TB) espinal toracolumbar pediátrica utilizando el abordaje anterior y el injerto óseo alogénico.*
Métodos: *Las lesiones de 16 niños diagnosticados con TB espinal toracolumbar fueron expuestas por vía del abordaje anterior. La pleura y el peritoneo, el tejido de granulación, el pus y el tejido óseo muerto por la tuberculosis, y el disco intervertebral con cambios patológicos y necrosis, fueron completamente eliminados . La columna anterior de la espina dorsal fue reconstruida usando el injerto de hueso alogénico (el ilion de la madre del niño operado). La protección de la inmovilización postoperatoria lograda mediante yeso duró de tres a seis meses, y el tratamiento regular anti-TB fue realizado durante más de un año.*
Resultados: *El procedimiento de seguimiento fue completado en un período de nueve meses a tres años. Todos los injertos óseos de los 16 casos se fusionaron sin rechazo, recurrencia de la patología, deformidad* nor *paraplejia, o formación de ps eudoartros is Los niños* tuvieron

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un desarrollo y crecimiento normal, y pudieron vivir una vida normal.
Conclusión: *Las lesiones de tuberculosis espinal en niños se eliminaron mediante el abordaje anterior. El hueso ilíaco de las madres se utilizó para reconstruir el injerto de la columna vertebral anterior de los niños, induciendo así la formación de hueso nuevo sin afectar el crecimiento y el desarrollo de los niños . La eficacia del desbridamiento fue definitiva.*

Palabras claves: Aloinjerto, niños, desbridamiento, tuberculosis espinal

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INTRODUCTION

Spinal tuberculosis (TB) in children is a very rare destruction-based chronic-wasting disease, and its early diagnosis is difficult (1–3). Many children diagnosed with spinal TB mainly experience back pain, which may progress to kyphosis and lower limb paralysis. Prior to correct diagnosis, the vertebrae and intervertebral discs of the children were significantly destroyed, and there was paraspinal abscess (4–6). Surgical treatment was a major and effective method of treating spinal TB (7, 8). A series of operation from January 2010 to September 2013 was performed, in which the lesions of 36 cases of thoracolumbar spinal TB were cleared out by using the anterior approach and bone allograft from mother's ilium were utilized. The operations achieved satisfactory results.

SUBJECTS AND METHODS

A total of 10 males and six females between the ages of six months to three years old and two months to nine years old, respectively, with durations of TB of two months to two years, were selected for this study. Four children had lesions in the chest, four had lesions both in the chest and waist and eight had lesions in the waist. Moreover, four cases had vertebral lesions, eight had two vertebra-combined vertebral disc lesions and four had two or more lesions in the vertebrae. A total of 12 cases had kyphosis and two patients exhibited symptoms of paraplegia. The results of X-ray examination showed that the vertebral bone mass was destroyed and the narrowing or disappearance of the disc space was observed. This study was conducted in accordance with the Declaration of Helsinki. This study was conducted with approval from the Ethics Committee of Zhengzhou City Children's Hospital. Written informed consent was obtained from all participants' guardians.

To significantly reduce the rate of erythrocyte sedimentation, the patients were allowed to rest in bed before the operation, received sustained nutrition, received regular anti-TB prescription for at least two weeks before undergoing surgery. The mother of each child performed the corresponding procedures to avoid surgery taboos, including the proliferation of infectious diseases. General anaesthesia was used in performing transthoracic echocardiogram to locate retroperitoneal outsiders to expose the lesions. The pus, cheese-like lesions, sequestrum, necrosis and the degeneration of intervertebral disc were carefully removed. Suspicious vertebral lesions were also thoroughly scraped. Iliac bones with an appropriately sized double-sided cortical bone were simultaneously removed from the mothers of the children in a different surgery by using either a local or epidural anaesthesia. The periosteum was carefully scraped and was repeatedly rinsed for transplantation. When the debridement process was completed, appropriate ground normal vertebrate was observed by Burr hole to form the trapezoidal transplantation bed, which protects the injured spinal cord. Moreover, the vertebral crest was propelled to the top to open to the leading edge of the vertebral body so that the physiological curvature of the spine was restored. The size of the bone defect was measured. The allograft iliac bone was prepared to perform grafting between the vertebral bone defects. The partial region was then washed and treated with isoniazid and streptomycin at an amount sufficient for one day. The incision was then sutured. The vertebral column was fixed with gypsum to protect the thoracolumbar spine of the children for three to six months. Anti-tuberculosis treatment was given for at least one-year. The X-ray films were periodically reviewed.

RESULTS

The 16 children survived all procedures. The surgical incisions of 15 cases healed at the first stage, whereas the healing of one case was prolonged. Sinus was not observed in any of the cases. The patients were then followed up for nine months to three years. One patient fully recovered from a paraplegic symptoms. A total of

16 cases had bone fusion with no rejection, recurrence, deformity or increase in paraplegia nor pseudarthrosis. The children had normal growth and development and were capable of living a normal life.

DISCUSSION

Generally, children cannot accurately articulate the discomfort or physical suffering they endure. Thus, diseases among children are normally diagnosed when the symptoms are already worse or when deformity has occurred (9, 10). Prior to performing the surgery, different measures were followed because children have poor pain tolerance against surgeries and the process involved in this study is tedious. The measures were as follows: 1) the nutrition of the children was improved to enhance their physical fitness and surgical tolerance; 2) the children were provided regular TB treatment for two to four weeks, and the erythrocyte sedimentation rate (ESR) changes were reviewed; 3) the children were instructed to stay in bed to reduce body exhaustion and to avoid further vertebral deformity caused by gravity; transplanted. 4) the quality of the films was improved; X-ray films and computed tomography (CT) examination images were indistinct because the children cried because of jitters, which caused difficulties in making a preoperative judgment. Appropriate sedatives were given to the children, who were filmed asleep to accurately understand the extent of bone destruction, scope and paraspinal abscess.

The timing of the surgery must be flexible for patients with poor health. Children with significantly increased erythrocyte sedimentation rate and systemic symptoms must immediately undergo surgery after they have completed the positive preoperative preparation and given regular TB treatment, which were expected to alleviate the systemic and local symptoms. Children with combined TB must receive anti-TB treatments first and then undergo surgery when their TB lesions became stable. This precondition is considered to reduce the risk of surgical complications (11, 12). However, children with apparent paraplegic symptoms must promptly undergo surgery; paraplegic symptoms are not absolute contraindication to surgery (7, 8).

Paediatric surgery was performed using general anaesthesia. The operation-time for the children was shortened because they tolerate bleeding less than adults and are more at risk. This time frame was completed under the principle of debridement with little damage and the lesion was completely removed. As such, the stability of the spine was ensured (13, 14). Completely eliminating TB was the key to the surgery. The abscess wall and sinus must be patiently and meticulously scraped. The pus, cheese-like substance, sequestrum, intervertebral disc, necrosis tissues, and TB granulation tissues, especially potential lesions, must also be thoroughly removed. The dead spaces must also be eradicated, and complete haemostasis must be obtained to avoid the formation of haematoma so that the latter will not be a source of recurrence. Performing a thorough debridement is the only means of improving the cure rate, thereby ensuring the healing of the bones.

In transplanting the allogeneic bone (mother's ilium to the child), the autologous ilium was limited, the strength of the iliac bone was negligible, the development of the ribs was incomplete and the shaping was difficult. Thus, the iliac bones of the children's mothers were obtained to design the allograft. The allograft is the most commonly used transplantation method following blood transfusion (15, 16). Allograft transplantation is different from other parenchymal organ transplantation. According to the accurate definition of allograft transplantation, the allogeneic bone is implanted rather than transplanted. The result of immunisation transplant rejection showed that the bone was absorbed. The clinical tissue typing for allograft transplantation was not used; the immunosuppressant r3l was also not employed in the tissue typing for allograft patients. Transplanting the iliac bone from mothers-to-children had the following advantages: 1) the operation-time could be shortened; the trauma, bleeding and surgical risk could also be reduced by obtaining the mother's ilium by another surgery group when the lesions of the children were cleared surgically; 2) the donor (mother's ilium of the children) and receptor (children) had high tissue compatibility; the iliac periosteum was carefully scraped and repeatedly washed to reduce graft antigens in the preparation, which greatly reduced the incidence of immune rejection; 3) the cortical and cancellous bones of the mother's ilium could greatly support and protect the reconstruction of the anterior column of the spine in children after transplantation. Meanwhile, the open structure of the cancellous bone was conducive to tissue fluid diffusion and vascular granulation tissue invasion, thereby promoting bone cells to induce direct contact with body fluids and provide easy access to nutrition. Endosteum with larger cancellous bone provided a considerable number of bone-producing cells to form callus on the affected area, which promoted the production of new bones; 4) the iliac bones of the children's mothers had sufficient strength. Thus, the bones were easily trimmed to the defect size and shape and were fixed for postoperative immobiliza-

tion procedure. The inner fixation could not be performed. It did not only affect the growth and development of the children but also removed the same exemption in the second surgery, which alleviated the suffering and reduced the financial burden of the patients; 5) eliminating the remaining dead space in the intervertebral area of the children after debridement may have an effect on haemostasis, thereby reducing bleeding among patients with healthy vertebra. As such, the formation of haematoma is prevented and the postoperative recurrence rate of TB is reduced.

Antibiotics were regularly administered to the patients after surgery to prevent surgical wound infection. The children also continued to adhere to anti-TB treatments and they also continued to rest in bed. Postoperative plaster immobilization protection is a necessity. Only bone graft was performed after surgical debridement because of the period of growth and development of children. The children had the strength to resist flexion and strong compression, but the power to resisted rotation, lateral bending and extension was poor. The graft bone moved and prolapsed when the patients changed posture. Thus, the spine twisted or the stretch gap increased. On the other hand, the local stability was destroyed. The bone could compress the spinal cord and large blood vessels, which would have serious consequences. Therefore, immobilization protection after surgery was done, the X-ray films were periodically reviewed and the plaster was replaced if not adequate. The plaster was not removed until the bone graft was completely fused (normally takes three to six months). The operation effectively avoided the shift of the bones and the collapse in the bone graft reconstruction.

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