ABSTRACT

Aim: In children suffering from severe hepatosplenic schistosomiasis, the surgical protocol includes splenectomy and autoimplantation of spleen morsels in the major omentum, which has the potential of reducing the overwhelming postsplenectomy infection (OPSI). The purpose of the study was to evaluate the remaining splenosis, with the mean postoperative followup of 12.1 ± 5.6 years; to compare the efficacy of the 2 evaluation tools. Materials and Methods: Nineteen patients underwent, when they were children, portal decompression and autoimplantation of spleen. After a mean age of 23.4 ± 5.3 years, they were investigated regarding the number of infections and OPSI. They had undergone hepatosplenic scintigraphy with labeled colloidal SnTc\textsuperscript{99m} and abdominal ultrasound. It was considered efficient splenosis when the patients presented with 5 or more spleen nodules. The evaluation was performed by 3 observers. Results: None of the patients had increased infection rate or developed OPSI. Sixteen (84.2%) presented efficient splenosis. Conclusions: The remaining postoperative splenosis was considered efficient in the majority of patients in the long-term followup; and nuclear medicine was considered the gold standard for splenosis evaluation.

INTRODUCTION

The hepatosplenic schistosomiasis mansoni (HSM) is hyperendemic in Brazil and is treated with praziquantel.\textsuperscript{[1,2]} The main factor of morbidity is the portal hypertension. In severe cases, surgery is the treatment for portal decompression by splenectomy and ligature of the left gastric vein, which reduces portal hypertension. Autoimplantation of spleen tissue in the omentum has the potential to reduce the risk of overwhelming postsplenectomy infection (OPSI).\textsuperscript{[3-11]}

The purpose of this study was to evaluate the presence and functionality of autoimplanted spleen tissue in the major omentum (splenosis) in children with HSM who underwent splenectomy and ligature of the left gastric vein, with a mean followup of 12.1 ± 5.6 years after surgery, and also to compare the effectiveness between the used methods (ultrasound and nuclear medicine).
18 years of age. The surgical procedure was splenectomy, ligature of left gastric vein, and autoimplantation of spleen tissue into a pouch of the omentum, between the years 1990 and 2005. The representative and randomized sample size was calculated in 20 patients. After randomization, one randomly selected patient died, and so the final sample was 19 patients with mean age of 23.4 ± 5.3 years.

In the original surgical procedure, about 8-12 fragments of spleen tissue without capsule, weighing approximately 100 g were implanted, in the major omentum (omental pouch). These patients were evaluated for infections or sepsis development. In addition, these patients underwent abdominal ultrasound\(^\text{[12]}\) and hepatosplenic scintigraphy with labeled colloidal stannous chloride (SnTc\(^{99m}\)) single photon emission computer tomography/computer tomography SPECT/CT. This examination was done in 20 min after tracer injection, SnTc\(^{99m}\) colloid. This material was injected, and once captured by the phagocytic system, which is part of the innate immune system, of the liver and spleen. After administration of the radiotracer the patient was taken to the gamma camera, for evaluation and pictures were taken in the anterior, posterior, right, left, and oblique positions.

The 2 methods aimed at detecting the presence of splenic nodules, and also scintigraphy function to evaluate the splenosis by counting the nodules visualized on image examination. Splenosis was considered satisfactory when the number of nodules was 5 or more, using 3 observers’ evaluation.

**RESULTS**

There was no increase in the infection rate and no OPSI in all patients of this series. The splenosis evaluation by ultrasound had less sensibility than hepatosplenic scintigraphy with labeled colloidal stannous chloride SnTc\(^{99m}\) SPECT/CT. In 10 patients (52.6%) splenosis in ultrasound were well defined [Figure 1]; however, in 9 patients, splenic nodules were not found.

All patients showed spleen morsels in SPECT/CT images [Figure 2] and most of the time their location were in the left flank and left iliac abdominal region. Sixteen (84.2%) patients presented effective splenosis with 5 or more morsels. But, in 3 (15.8%) the definition of 5 morsels was not precise. The mean number of morsels seen in the nuclear medicine was 6.8 ± 1.8. The splenosis SnTc\(^{99m}\) uptake was compared with SnTc\(^{99m}\) liver uptake in the same projection and classified in 4 grades: grade I—mild uptake, grade II—mild to moderate uptake, grade III—moderate uptake and grade IV high uptake of spleen morsels. Mild to moderate radiotracer uptake (grade II) was found in 63.15% of the patients.

**DISCUSSION**

The surgery to decompress the portal system in patients with HSM has been carried out in various ways, including bypass and porto-systemic-azygos disconnection.\(^\text{[12-14]}\) The maintenance of spleen tissue, after splenectomy is very important for the patient’s immunity, particularly in children.\(^\text{[7,8]}\) Even in situations where the disease affects major portion of the spleen, as in the case of large hemangioma, partial splenectomy may be the best alternative.\(^\text{[15,16]}\)

Some studies\(^\text{[4,6]}\) of splenic nodules self-implantation into the major omentum has been done using sulfur colloid labeled (splenosis) with technetium-99; however, in this series of late followup tin was used. This mineral has good specificity for marking the reticuloendothelial system, where quality control is done properly.\(^\text{[17]}\) In this sense, nuclear medicine was
of greater accuracy and specificity for mapping of the remaining splenic nodules after an average followup of more than 10 years.

The study by ultrasound has limitations, because it is a test observer and machine dependent. In the current study, the examination was performed by one of the authors, who was not a radiologist, using a machine for research purposes. It is considered that if the image investigation had been done by an experienced radiologist and better ultrasound[12] the results could be different when comparing the two methods.

The most important clinical fact is the clinical observation that in no patient infection rate increased and they did not develop fulminant sepsis (OPSI) after splenectomy. Previous studies from the same group showed that tutsin production is maintained in these patients,[6] as well as the levels of IgM and IgG are also maintained in normal levels.[14] Furthermore, the positive response to pneumococcal vaccination is achieved by 65% of the patients.[18] This information tends to support the hypothesis of efficient splenosis in the long-term followup seems to be associated with immune protection for OPSI in these patients after splenectomy, even on those who have other diseases rather than hepatosplenic schistosomiasis mansoni.

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