

## Amniotic Membrane Wrapping: An Alternative Method to the Splenorrhaphy in the Injured Spleen

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### Summary

Human amnion, which has been used experimentally and clinically as an ideal bioprosthesis, was used in the present study to wrap the experimentally injured spleens and the technique was compared to splenorrhaphy. Standard splenic injuries were made on 30 male albino rats. 15 of the spleens were repaired by splenorrhaphy and the other 15 were wrapped with sterile human amniotic membrane. Isotope uptakes of the spleens calculated at the 30th postoperative day were similar in both groups ( $p < 0.05$ ). But the histopathological examination revealed a better healing in the amnion group with better preservation of the splenic architecture. It was concluded that in heavily injured spleens, amnion wrapping may be an effective alternative to splenorrhaphy.

### Key words

Splenic injury - Amnion

### Résumé

L'amnion humain considéré comme une bioprothèse idéale tant en clinique qu'en expérimentation, a été utilisé pour envelopper les rates endommagées. Les résultats obtenus ont été comparés avec la splénorrhaphie. Des lésions spléniques standardisées ont été effectuées chez 30 rats albinos de sexe mâme. 15 plaies spléniques sont traitées par splénorrhaphie et 15 autres sont enveloppées dans une membrane stérile d'amnion humain.

Au 30ème jour post-opératoire, les résultats scintigraphiques sont semblables dans les deux groupes

( $p < 0.05$ ). Par contre, l'étude histologique révèle une meilleur cicatrisation du groupe traité avec l'amnion. Ceci permet de conclure que devant une lésion grave de la rate l'envelopper dans une membrane d'amnion est une alternative efficace à la splénorrhaphie.

### Mots-clés

Endommagement splénique - Amnios

### Zusammenfassung

Menschliches Amnion wurde in dieser Studie zur Milzumwicklung nach experimentell durchgeführten Milzverletzungen verwandt und ein Vergleich zur Technik der Splenorrhaphie gezogen. Bei 30 männlichen Albinoratten wurden Milzverletzungen erzeugt und bei 15 Tieren durch Amnion-Membran-Umwicklung, bei 15 Ratten mittels Splenorrhaphie operativ behandelt. Isotopen-Untersuchungen zeigten 30 Tage post operationem keinen Unterschied zwischen beiden Vergleichsgruppen ( $p < 0.05$ ). Bei der histopathologischen Untersuchung ließ sich aber in der Gruppe der mit Amnion-Membran-Umwicklung behandelten Ratten eine bessere Heilungstendenz mit einer besser erhaltenen Gewebsarchitektur nachweisen. Wie die Ergebnisse belegen, ist bei schweren Milzverletzungen die Amnion-Membran-Umwicklung eine effektive alternative Therapie zur Splenorrhaphie.

### Schlüsselwörter

Milzverletzungen - Amnionumwicklung

### Introduction

The spleen, which is the most commonly injured intraperitoneal organ in blunt abdominal trauma, has been known to possess an active role in the immune defense mechanism of the organism. Although Zikoff had suggested

splenorrhaphy a hundred years ago, splenectomy had been performed as the standard therapy for many years (3). However, after the postulation of the increase in the infection risk and the presentation of the high mortality of postsplenectomy sepsis especially in children, splenic salvage techniques became more popular (7). Besides splenorrhaphy, partial splenectomy, splenic artery ligation and splenic autotransplantation have been used to leave a functioning splenic tissue to the patient (1). In addition, nonoperative therapy is employed in appropriate patients by many centers today with the objective of minimizing iatrogenic trauma to the patient.

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Splenorrhaphy has been the most frequently performed splenic salvage procedure. On the other hand, it may become a cumbersome exercise occasionally for some splenic injuries with multiple lacerations. In order to maintain the integrity and inner construction of the spleen, wrapping it with an absorbable material, like polyglycolic acid mesh had been suggested as an alternative technique (2). In this study, we used human amniotic membrane to wrap experimentally injured rat spleens and evaluated the results histopathologically and scintigraphically.

### Materials and methods

30 male albino rats were used in the experiment weighing approximately 200 g each. After an acclimatization period of one week in the laboratory, the rats were anesthetized with chloral hydrate (300 mg/kg) intraperitoneally and laparotomies were done with median superior incision. The spleens of all animals were amputated at the upper and lower poles. An additional cross-shaped laceration was made through the mid-lateral surface of the spleens (2) (Fig. 1).

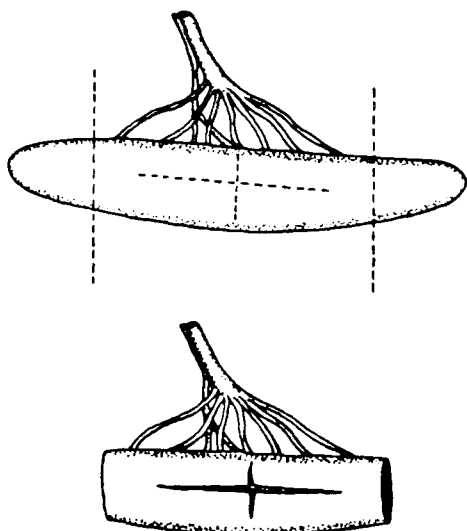


Fig. 1 The experimental injury of the rat spleen.



Fig. 2 Amniotic membrane wrapping procedure.

The spleens of 15 rats (Group I) were repaired with splenorrhaphy using 6/0 chromic catgut. The spleens of the other 15 rats (Group II) were wrapped with human amniotic membrane prepared in a manner described by Robson et al (5). A small piece of amnion 2 cm in diameter was used to wrap the injured spleen and the free edges were constricted with a purse string suture around the splenic hilus (Fig. 2). The abdominal incisions were closed with 4/0 polyglycolic acid sutures in one layer.

On the 30th postoperative day, all the rats were given intravenous Tc-99m sulphur colloid (1 m Curie/100 g of body weight) and scintigrams were taken with a Toshiba-GCA-601 gamma camera. Isotope uptake of the spleen and its rate to the background activity were calculated separately for each animal after taking the spleen out of the body. All of the spleens were examined histopathologically after fixation in 10% formaldehyde.

Student's t-test was used when comparing the splenic uptake/background activity ratios of the groups.

### Results

Hemostasis was satisfactory in both groups and all of the animals survived until the end of the experiment. There were no signs of peritonitis or wound infection in any of the animals.

Because of the superposition of the scintigraphic images of the liver and spleen, clear scintigrams showing the spleen alone could not be obtained. However, the high uptake value of the spleen when compared to the background activity was considered as evidence of functioning splenic tissue. Statistical evaluation revealed no significant difference between the splenic uptake/background activity ratios of the two groups ( $p < 0.05$ ).

According to the histopathological examination:

- Group I: Inflammatory changes due to the suturing material used in the repair were striking, rather than hematoma and its organisation. Those changes destroyed the integrity of the spleen in most of the sutured specimens (Fig. 3a).
- Group II: Foreign body reaction was minimal. There were some areas of organized hematoma between the amnion and spleen. Macrophages loaded with hemosiderin pigment were observed in the red pulp. But the integrity of the splenic tissue was perfectly preserved (Fig. 3b).

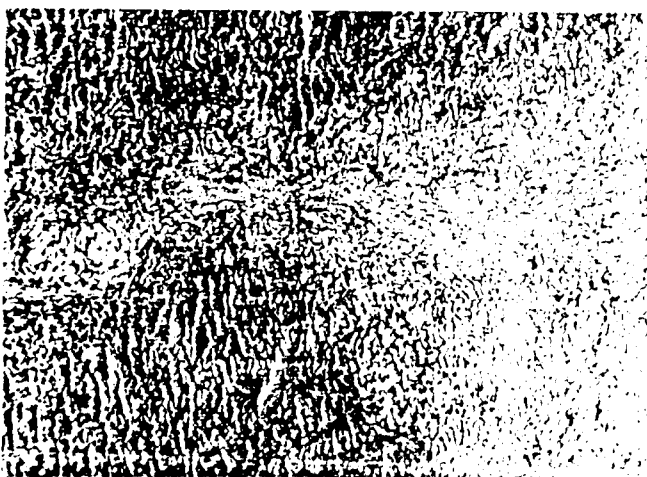


Fig. 3a

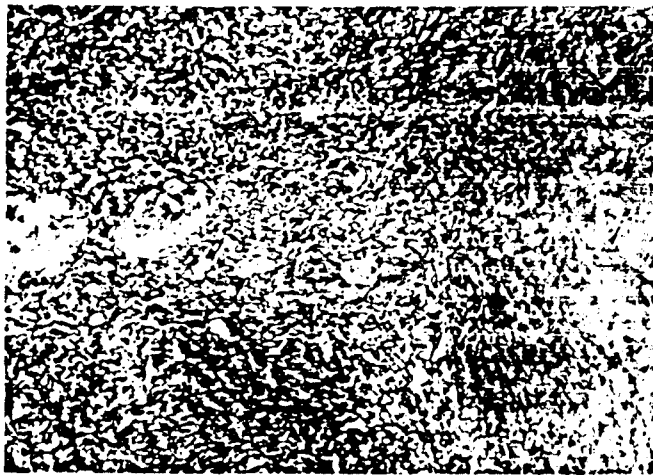


Fig. 3b

Fig. 3a and b Histopathological changes in the spleens of (a) splenorrhaphy group (Group I) and (b) amnion group (Group II).

### Discussion

After the gradually increasing acceptance of the fact that splenectomy was not the first choice in the management of splenic trauma, splenorrhaphy became the most popular of the alternative surgical methods. In 1982 Delany et al suggested wrapping the spleen externally with woven polyglycolic acid mesh in heavily ruptured spleens and the technique was proposed to render a more effective hemostasis, a better preservation of the integrity of the splenic tissue architecture and to be less time consuming (2): the authors noted that, although less than cotton, silk or catgut, some tissue reaction and collagen deposition occurs with phagocytosis by foreign body giant cells at the polyglycolic acid suture site. We used human amniotic membrane in place of polyglycolic acid mesh in this study. Amnion is recommended by many authors as an excellent bioprosthesis which could be obtained cheaper than its equivalents (4, 6, 8).

Amniotic membrane wrapping technique was at least as effective as splenorrhaphy in hemostasis and maintenance of function, according to isotope uptake ratios. Delany et al obtained similar results in dogs with polyglycolic acid mesh (2): they also used deep sutures inserted through the mesh with the mesh acting as a bolster. With its non-porous sur-

face, amnion could provide better hemostasis than mesh, avoiding parenchymal sutures.

Splenic architecture was better preserved in spleens wrapped with amnion than the ones repaired with primary suture. The formation of hematoma between the spleen and the amnion may be due to the relatively soft and pliable nature of the rat spleen which prevented amnion from constricting it efficiently. The procedure may be expected to be performed more easily and more effectively in the larger subject.

The ideal treatment for the injured spleen may be obtained by a most natural way where no foreign bodies come into the media: therefore, non-operative therapy would seem to be the preferable form of management. But when there is definite indication to operate, the least harmful technique and material should be used in the repair. From this point of view, amniotic membrane wrapping may be an effective alternative to splenorrhaphy in the repair of the heavily injured spleen.

### References

- 1 Buntain WL, Gould HR: Splenic trauma in children and techniques of splenic salvage. *World J Surg* 9 (1985) 398-409
- 2 Delany HM, Porreca F, Mitsudo S, Solanki B, Rudarsky A: Splenic capsling: An experimental study of a new technique for splenorrhaphy using woven polyglycolic acid mesh. *Ann Surg* 196 (1982) 187-193
- 3 Dulchavsky SA, Lucas CE, Ledgerwood AM, Grabow D: Wound healing of the injured spleen with and without splenorrhaphy. *J Trauma* 27 (1988) 1155-1160
- 4 Fishman IJ, Flores FN, Scott FB, Spjut HJ, Morrow B: Use of fresh placental membranes for bladder reconstruction. *J Urol* 138 (1987) 1291-1294
- 5 Robson MC, Krizek TJ, Koss N, Samburg JL: Amniotic membranes as a temporary wound dressing. *Surg Gynecol Obstet* 136 (1973) 904-906
- 6 Scudamore CH, Becker CD, Fache JS, Bianco R, Shackleton CR, Burhenn HJ, Owen DA, Schechter MT, Seccombe D: Human amnion as a bioprosthesis for bile duct reconstruction in the pig. *Am J Surg* 155 (1988) 635-640
- 7 Shaw JHF, Print CG: Postsplenectomy sepsis. *Br J Surg* 76 (1989) 1073-1081
- 8 Trelford JD, Trelford SM: The amnion in surgery, past and present. *Am J Obstet Gynecol* 134 (1979) 833-845

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