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Creation and Viability of an Isolated Jejunal Segment Using the Omentum as Vascular Pedicle†

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= Abstract =**To evaluate the feasibility of the creation of an Isolated Jejunal Segment (IJS) which is devoided of its anatomical blood supply and nourished by the omentum, the experimental loop was created in rats and its viability was examined microscopically. The procedure of creating IJS is: 1)ligation of the mesenteric vessels and the arcade vessels of a jejunal segment, 2)fixation of the omentum to the serosa of the segment(about 3 cm), 3) 6 weeks after, isolation of the segment by division of both ends. At the same time bowel continuity was restored, and the IJS was left in the peritoneal cavity freely. For evaluation of viability the experimental segment was harvested 2 weeks after creation and examined microscopically after hematoxylin and eosin staining. All 13 IJSs were viable, 10 showed normal architecture and 3 showed atrophy of the mucosa and muscle layer and dilatation of the lumen filled with mucus . In conclusion an isolated bowel segment can be created using omentopexy technique.**

Key Words; *Isolated jejunal segment, Omentopexy, Viability*

INTRODUCTION

As a technique for lengthening the intestine an isolated bowel segment(IBS) was created using myoenteropexy technique in rats (Kimura *et al.* 1990). In this technique the undersurface of abdominal wall muscle is sutured to the serosa of a bowel loop. This technique was developed because the technique clinically used these days to lengthen the intestine requires mesentery to bisect the bowel longitudinally (Bianchi 1984). But in severe intestinal atresia sometimes the duodenum is the only candidate for bowel lengthening which means Bianchi's method can not be applied. In this circumstance myoenteropexy technique is useful. But the myoenteropexy technique is not physiologic because the venous blood does not drain into the portal system and the abdominal wall is fixed. If the omentum can nourish the IBS the venous blood will drain into the portal system and the IBS will be more mobile.

This paper describes the technique for creating an isolated jejunal segment using omentopexy and the viability of IJS in rats.

MATERIALS AND METHODS

Animals and diet Sprague-Dawley rats

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weighing 300 - 330 g were used. The animals received standard pellet diet and water *ad libitum*.

Creation of isolated jejunal segment 1) omentopexy: the rats were fasted 16 -20 hours before operation but were allowed free access to water. Animals were anesthetized with an intraperitoneal injection of chloral hydrate (350mg/kg). After skin preparation a midline incision was made in the upper abdomen and the peritoneal cavity was entered. A segment of proximal jejunum which was fed by the same mesenteric artery(usually about 3 cm) was selected then the mesenteric artery and the arcade artery were ligated and divided (Fig. 1A). The serosa was scratched with abrasive paper (1000 Cw, Daesung Co.) until capillary bleeding was visible. The omentum was pulled down and was scratched in the same manner on one surface from the tip for 3 cm (Fig. 1A). The scratched surface of the omentum was wrapped around the serosa and was secured

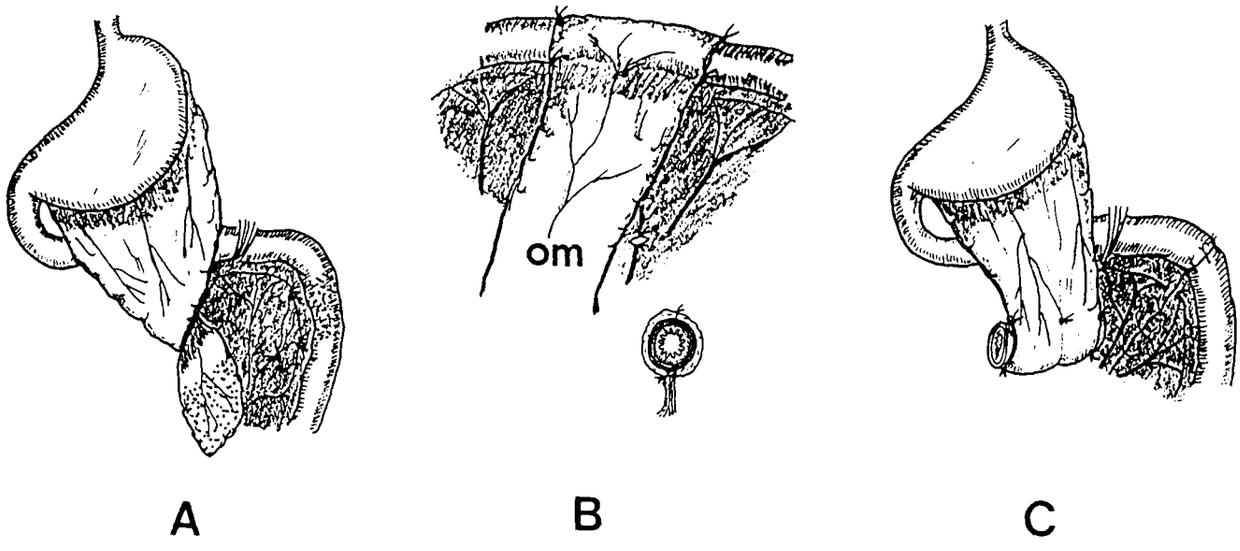

Fig. 1. Creation of isolated jejunal segment. (A) The serosa of the jejunum and one surface of the omentum(OM) were scratched until capillary bleeding was seen with fine abrasive paper. (B) The omentum was wrapped around the jejunum and was secured with 5-0 interrupted black silk sutures. (C) 6 weeks later both ends of the experimental loop were divided and bowel continuity was restored. The IJS was left in the peritoneal cavity freely.

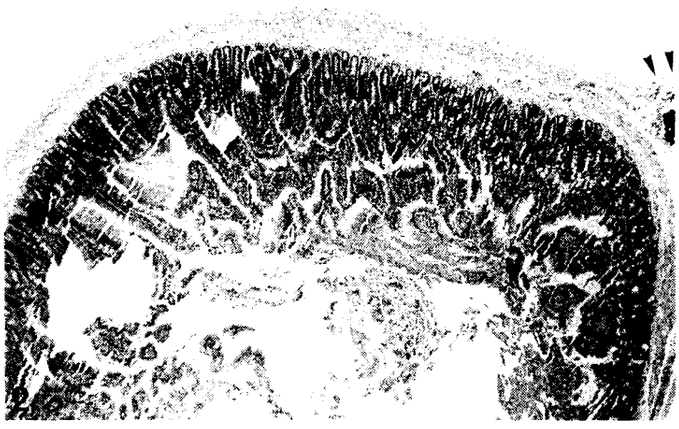

Fig. 2. Photomicrograph of the normal rat jejunum. Attached mesentery is seen (Arrow) (H&E x40).

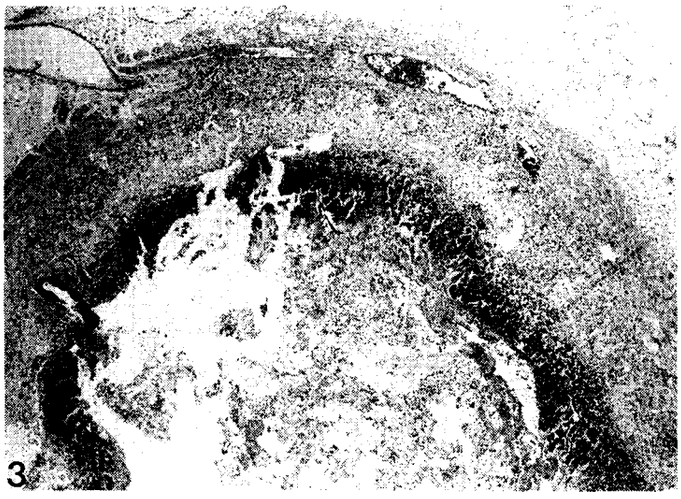

Fig. 3. IJS harvested after death. Inflammatary cell infiltration is observed (H&E x40).

by several interrupted 5-0 black silk sutures (Fig. 1B). After intraperitoneal injection of ampicillin 100 mg the abdominal wall was closed by one layer continuous 3-0 prolene suture. The animal was fed 12 hr later. **2) Isolation of the omentopexied segment:** The peritoneal cavity was reentered 6 weeks after omentopexy. The experimental segment was identified and isolated by division of both ends and the mesentery, and bowel continuity was restored by end-to-end 5-0 interrupted black silk sutures (Fig. 1C). The preparation of the animal was the same as for omentopopexy but the animals were fed 24 hr later. The isolated jejunal segment was left in the peritoneal cavity freely until it was harvested (Fig. 1C).

Evaluation of viability: Two weeks after creation of IBS the peritoneal cavity was reenterd and the IBS was harvested and a segment of the intestine proximal to the IBS was taken as control (Fig. 2). The specimens were examined under light microscopy after hematoxylin and eosin staining. Viability was determined by presence or absence of intestinal tissue.

RESULTS

Out of 20 rats in which the IJS was created, seven rats were found dead before harvesting IJS. Although it is hard to evaluate viability because of postmortem change it is presumed that 5 of the 7 IJS were viable (Fig. 3). The remaining 2 IJSs were impossible to evaluate because of severe postmortem change but tubular structure was identifiable.

In 13 rats the IJS was harvested 2 weeks after creation of the IJS. Entering the peritoneal cavity the IJS was adhered to the adjascent organs but easily identified. On microscopic examination 13 specimens were all viable. Ten out of the 13 IJSs showed normal intestinal architecture (Fig. 4) and three showed atrophy of mucosa and muscle layers with cystic dilatation(Fig. 5).

DISCUSSION

Little is known about revascularization and survival of intestinal transfers after late interruption of their mesenteric blood supply. Transferred intestinal segments appear to behave much as other more familiar flap transfers. Like other tissue transfers, there is a need for perfusion through the pedicle while the bowel gains independence from it, i.e., the segment cannot survive initially as a free graft when the intestinal segment is placed in the subcutaneous space as a free graft, i.e., without a vascular pedicle, all completely necrosed (Cohen 1987).

Creation of isolated bowel segment using myoenteropexy technique was described by Kimura *et. al.* (1990). in Kimura's technique the

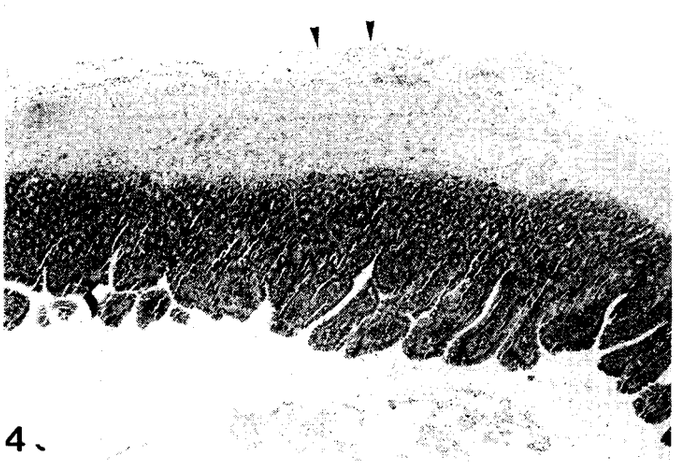

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Fig. 4. IJS harvested 2 weeks after creation. The surrounding omentum(arrow) is clearly seen (H&E x100).

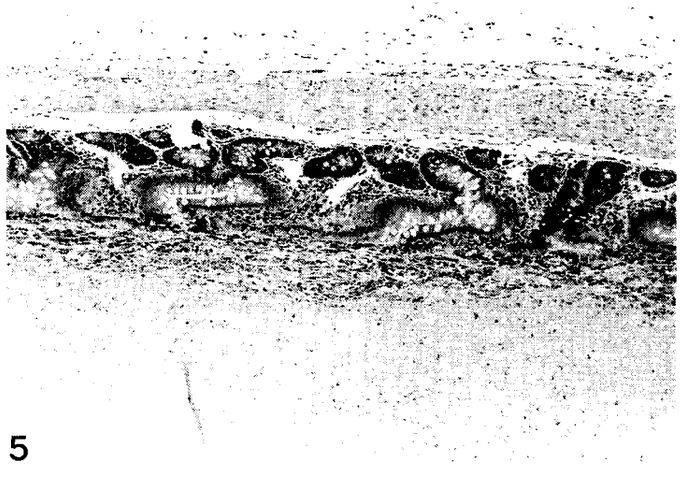

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Fig. 5. IJS showing cystic dilatation and thinning of the bowel wall (H&E x100).

antimesenteric side of the bowel segmemt is myoenteropexied to the undersurface of the abdominal wall. In Kimura's technique the mesenteric side is opposite to the myoenteropexy site which means more time is required to avoid ischemia before division of the mesentery. Ienaga *et al.* (1990) reported that using Kimura's technique 7 weeks is necessary before dividing the mesentery to avoid ischemia of the isolated bowel segment. Tisinai *et al.* (1990) reported fetal intestinal transplantation into the omentum in syngeneic rats. They only stripped the mesentery and harvested the specimens at 2 weeks posttransplantation. Viable grafts were identified in 34 of 40 grafts and neovascularization was observed between the graft and omentum. Cohen (1987) successfully severed the vascular pedicle of the intestinal segment transferred into the subcutaneous space without loss 30 days after transfer and demonstrated new vessel ingrowth from the recipient wound into the intestinal segment. The technique the author described uses omemtopexy which was performed around the bowel loop. This means proximity of blood supply from the omentum around the loop. In the author's technique *i.e.*, omentopexy, a shorter period maybe is necessary. Although a 6 weeks interval was adopted 4 weeks should be enough. The interval between omentopexy and creation of IJS, and the motility and absorption of the IJS require further study.

The dilatation of the 3 IJSs may have been caused by the obstruction of both ends by adhesion or by an absence of extrinsic adrenergic inhibitory innervation (Taguchi *et al.* 1989) in the IJS.

From a clinical perspective, the implications emerge that because the omental blood drains into the portal system and the omentum is mobile an IJS created by omentopexy is more physiologic than an IBS created by myoenteropexy, and the IJS can be transferred to a distant location, *i.e.*, the esophagus,pharynx, *etc.*, because of the great mobility of the omentum.

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