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## Is Multiple Organ Failure a Contraindication for Liver Transplantation in Children?

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**M**ULTIPLE organ-system failure (MOSF) is a well-recognized entity responsible for a high mortality in pediatric patients in the intensive care unit.<sup>1</sup> MOSF implies the failure of at least two organs,<sup>1,2</sup> and although the etiology is not clear, sepsis is a common denominator.<sup>3</sup>

Liver transplantation is the treatment of choice for patients with end-stage liver disease.<sup>4</sup> The impact of preoperative MOSF on survival after liver transplantation is not known. In some patients MOSF may develop in the terminal stages of liver failure, and in such patients sepsis may not be present. Another group includes patients who develop MOSF before retransplantation due to failure of the primary graft. In this latter group sepsis is almost always present, such as from intrahepatic abscess following thrombosis of the hepatic artery and cholangitis due to biliary strictures.<sup>5,6</sup>

The purpose of this investigation was to study survival after liver replacement (primary or retransplantation) in pediatric patients with MOSF.

### METHODS

A retrospective analysis was made of the medical records of 144 children (<18 years of age) who received hepatic transplantation at Children's Hospital of Pittsburgh from July 1, 1984 to June 30, 1986. Twenty-two patients were confirmed as having MOSF before primary grafting or retransplantation using the criteria for organ failure described by Wilkinson et al,<sup>1</sup> except that in our study renal failure was defined as creatine greater than 1 mg/dL and/or BUN greater than 100 mg/dL. The other difference was that all our MOSF patients had two or more organs failing simultaneously at the time of transplantation. Data pertaining to the cardiovascular, respiratory, neurologic, hematologic, and renal systems were recorded. Mortality was defined as that occurring in hospital.

### RESULTS

Twenty-two patients had MOSF before undergoing primary grafting or retransplantation. The 11 boys and 11 girls ranged in age from 4 months to 15 years (mean, 49 months); six patients were younger than 1 year. The weight ranged from 5.3 kg to 47 kg (mean, 15 kg).

Nine patients had MOSF before primary transplantation, and in the other 13 patients MOSF developed after the primary allograft failed and before retransplantation.

The diagnostic indications for hepatic replacement are listed in Table 1. The precipitating causes of MOSF were liver dysfunction or intrahepatic sepsis (13 cases), extrahepatic sepsis (five cases), CNS disorders (two cases), renal failure (one case), and undetermined (two cases). At the time of surgery ten patients had failure of two organ systems, and 12 patients had failure of three or more organ systems. Liver failure was present in 20 patients, CNS failure in 12, respiratory system failure in six, cardiovascular system failure in six, and renal failure in five.

### SURVIVAL

Nine of the 22 patients (40%) survived. Survival was 55% (five of nine patients) in

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**Table 1. Disease Indications for Hepatic Replacement**

| Disease                        | No. of Patients |
|--------------------------------|-----------------|
| Biliary atresia                | 11              |
| Fulminant hepatitis            | 4               |
| Alpha-1-antitrypsin deficiency | 1               |
| Glycogen storage disease       | 1               |
| Tyrosinemia                    | 1               |
| Cystinosis                     | 1               |
| Other                          | 3               |

patients undergoing first transplants and 30% (four of 13 patients) in patients undergoing retransplantation. Survival was 60% (six of ten) in patients with failure of two organ systems and 25% (three of 12) in patients with failure of three or more organ systems.

The number of major complications also paralleled survival. Two of three patients with no postoperative complications survived, but only four of 17 patients with four or more major complications survived.

The average hospital stay was 67 days, 42 days for nonsurvivors and 102 days for survivors.

#### DISCUSSION

MOSF is a well-recognized entity in surgical patients after severe trauma or postoperative complications.<sup>3,7</sup> Mortality varies from 57% to 100% in the population at risk, depending on the number of failing organ systems.<sup>7</sup> Similar findings were observed by Wilkinson et al,<sup>1</sup> in a study of pediatric patients with MOSF. They reported an over-

all survival rate of 46% in 226 patients with failure of two or more organ systems. Mortality increased according to the number of failing systems and reached 75% in patients with four failing systems.<sup>1</sup>

Patients with chronic liver failure are debilitated and prone to complications; therefore it is not surprising that MOSF developed in several patients awaiting hepatic transplantation. It is also expected that in such debilitated patients MOSF would develop after failure of the first allograft, particularly in the presence of infection. What is not clear is whether MOSF is a contraindication for liver transplantation. In the present investigation there is a direct correlation between the number of failing organ systems and the mortality; nevertheless nine (40%) children with MOSF survived. Therefore MOSF per se is not an absolute contraindication to hepatic transplantation.

Since the availability of pediatric livers is limited, the use of such organs in patients with three or more failing organ systems should be carefully scrutinized. If intrinsic liver disease is the cause of MOSF, replacing the diseased liver may be a reasonable approach (Matuschak GM, Shaw BW Jr, unpublished observations). On the other hand, if the cause of MOSF is extrahepatic, the indications for liver replacement are less clear, and a prospective study is needed to establish guidelines for the proper allocation of organs in patients with liver disease and MOSF due to extrahepatic causes.

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