

# Artificial liver support molecular adsorbents recirculating system therapy as a bridge to re-transplantation in two cases of long anhepatic duration

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**BACKGROUND:** Molecular adsorbents recirculating system (MARS) liver support therapy is the development of albumin dialysis. This study was to assess the successful application of MARS artificial liver support therapy as a bridge to re-transplantation in two cases of long anhepatic duration.

**METHODS:** MARS therapy was given after failure plasma-exchange (PE) treatment, which resulted in circulatory derangement and acute renal dysfunction in a 36-year-old male patient. Finally his uncontrolled anhepatic condition led to a successful re-transplantation. In another 48-year-old man who was diagnosed as having primary nonfunction (PNF) during the liver transplantation, 10-hour MARS treatment contributed to smooth bridging of his anhepatic phase.

**RESULTS:** The two anhepatic patients were bridged for 26 and 17 hours respectively to re-transplantation with MARS therapy.

**CONCLUSION:** Our experience proves that MARS artificial liver can be an effective support for long time bridging PNF until re-transplantation is available.

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**KEY WORDS:** artificial liver support;  
liver transplantation; anhepatic;  
molecular adsorbents recirculating system

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## Introduction

Liver transplantation remains a final choice for many patients with end-stage liver disease, but it may bring about no function of the donor liver and the necessity of re-transplantation.<sup>[1]</sup> In the condition of no donor source available, the patient without the liver means no therapy can be applied and the only practical way is to depend on artificial liver to live through the period.<sup>[1]</sup> We reported our experience with successful bridging in two anhepatic cases for 26 and 17 hours respectively to re-transplantation with molecular adsorbents recirculating system (MARS) therapy.

## Report of cases

### Case 1

A 36-year-old man underwent liver transplantation on October 23, 2002 because of primary liver cancer and posthepatic cirrhosis. Unfortunately, the anhepatic phase started at operation time at 18:00 since the implanted donor liver presented primary nonfunction (PNF) with severe swelling and resected afterwards. Subsequently, portal-cava shunt was performed and 1600 ml of fresh frozen plasma was given; but circulatory derangement and acute renal dysfunction including severe electrolyte disturbance occurred despite marked improvement of coagulopathy and decrease of serum level of transaminases. Thus MARS therapy was prescribed to bridge his anhepatic condition and improve his multi organ functions, particularly hemodynamics. The well-tolerable procedure resulted in an immediate reversion of deranged hemodynamics and gradual improvement of severe clinical symptoms including hepatic encephalopathy. The anhepatic condition of the patient was stably controlled during 11 hours of MARS treatment until 20:00 on the next day. At the 26th hour of the anhepatic phase, re-transplantation was successfully performed. The patient recovered uneventually after the operation and discharged soon af-

**Table.** Effect of MARS treatment in 2 anhepatic patients

Parameters	Patient 1		Patient 2	
	Pre-PE	Post-PE	Pre-MARS	Post-MARS
Lactic acid (mmol/L)	15.6	16.4	15	15
Ammonia ( $\mu\text{g}/\text{dl}$ )	27	29	37	33
GPT (IU/L)	4778	1796.4	1000	741.5
GOT (IU/L)	5376	2131.2	816	654.4
TB ( $\mu\text{mol}/\text{L}$ )	59.5	61.7	73.7	37.6
DB ( $\mu\text{mol}/\text{L}$ )	25.3	25.6	15.83	27.2
BUN (mmol/L)	5.92	5.53	4.67	3
Cr ( $\mu\text{mol}/\text{L}$ )	89.4	159.1	146.33	136
PT	35.4	19.6	15.2	13
INR	3.79	1.78	1.27	1.05
MAP (mmHg)	70	66	70	80
Dopamine ( $\mu\text{g} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$ )	0	0	0	0
NA ( $\mu\text{g} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$ )	0	0	0	0

GPT; glutamic pyruvic transaminase; GOT; glutamic oxalacetic transaminase; TB; total bilirubin; DB; direct bilirubin; BUN; blood urea nitrogen; Cr; creatinine; PT; prothrombin time; INR; international normalized ratio; MAP; mean arterial pressure; NA; noradrenalin.

ter (Table).

### Case 2

A 48-year-old man received urgent liver transplantation for his acute hepatic failure caused by chronic severe hepatitis and posthepatic cirrhosis complicated by encephalopathy. The liver transplantation was performed on November 6, 2002. The patient was found PNF during the operation, thus MARS therapy was given for bridging his anhepatic phase soon after removal of the transplanted liver. Ten hours after MARS treatment, his renal dysfunction and circulatory disturbance were improved with markedly decreased creatinine level and decreased use of dopamine and noradrenaline for the treatment of dropped mean arterial pressure. Bridging was sustained for 17-hour for the anhepatic phase until the new donor organ was available for a successful re-transplantation (Table).

### Discussion

Graft dysfunction caused by primary graft nonfunction, technical complications, or rejection following liver transplantation is usually associated with a complex clinical course affecting multiple organ systems. It is indicated for the application of MARS in surgical patients. In several centers including ours, MARS has successfully been used to assist bridging to re-transplantation in patients with primary graft nonfunction. Other potential applications of MARS for patients with such complications as chronic rejection after liver transplantation are currently being investigated.<sup>[2]</sup>

It has been reported that the MARS artificial liver has made a patient live through an anhepatic phase for 70 hours.<sup>[3]</sup> In this study the two anhepatic patients who had been stood by the operation and successfully bridged to re-transplantation were first reported in China.

Interestingly plasma-exchange (PE) did cause some

minor changes in parameters such as markedly decrease of bilirubin and PT or INR in case 1, and it was thought to be caused by the massive supplement of clotting factors and neutralization by a large volume of plasma, which for sure benefited him more or less. They were thought to be caused by the supplement of clotting factors and neutralization by a large volume of plasma. Nevertheless, the disturbance of circulation and damage of other organs were also due to the side effects and inherent defectiveness of PE.<sup>[4]</sup> The safety of MARS and the beneficial effects observed in our patients support the application of this liver assist device.

The report of the two anhepatic patients proves that MARS artificial liver can be of an effective support for long time bridging PNF until re-transplantation is available.

### Competing interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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