LETTER TO THE EDITOR

Living donor liver transplantation for fulminant hepatic failure from ABO-incompatible donors

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We read the article by Toso *et al.* [1] with great interest. They described the acceptable outcomes after liver transplantation (LT) using ABO-In (ABO incompatible) grafts for the patients with acute liver failure (ALF). In contrast, no living donor liver transplantation (LDLT) series using ABO-In grafts for ALF have yet been reported in the literature. In order to add more information regarding this issue, discussed in the article by Toso *et al.* [1], we herein report our series in LDLTs using ABO-In grafts for ALFs.

We started to use the ABO-In hemi-liver grafts from living donors for ALF from 2001, and that applies to only three cases so far in total (Table 1). The limited number of the cases is due to the extremely challenging combinations: ABO-In donor, partial graft and ALF. The baseline immunosuppression consisted of tacrolimus, mycophenolate mofetil and steroids. Splenectomy and plasma exchange were performed for all the cases. Rituximab (375mg/m^2) was administered for the second patient, and iv. immunoglobulin (IVIG) was administered to the third patient. Portal infusion treatment including prostaglandin, nafamostat mesilate and steroids was applied for the first two cases, but it was abandoned for the third case, because rituximab had been reported to be quite effective. The survival rate for these cases was 67.7%; the first case was lost on account of portal vein thrombosis on day 23 after the LDLT, the other two cases are doing well with normal liver function tests for 24 and 9 months post LDLT, respectively. Portal vein thrombosis in the first case seemed to have been caused on account of the portal catheter itself or the medications infused directly into the portal vein. The second case had hepatic artery dissection, which required surgical revision on day 16 post LDLT. All three patients experienced cytomegalovirus antigenemia, which was treated successfully with gancyclovir infusions.

Table 1. Summary of the ABO-In LDLTs for ALF.

	Case #1	Case #2	Case #3
Recipients			
Age/gender	63/F	21/F	20/F
Etiology	Autoimmune	Wilson	Unknown
MELD score	25	19	20
Donors			
Age/gender	32/M	46/F	54/M
Relationship to recipient	Son	Mother	Father
Blood type combination	A to O	AB to B	A to O
Graft type	Right lobe	Right lobe	Right lobe
GV (ml)	650	520	600
GV/SLV (%)	52.3	45.8	50.3
Iso-agglutinin titers (IgG)			
Pre-LDLT initial	128	64	2048
At the time of LDLT	4	2	128
Post-LDLT peak (day)	16 (day 15)	1024 (day 7)	2048 (day 7)
Immunomodulation			
Portal infusion	O	O	X
Plasma exchange	O	O	O
Splenectomy	O	O	O
Rituximab (day)	X	O (−3rd day)	O (−3rd day)
IVIG	X	X	O
Complications			
Cytomegalovirus	O	O	O
Portal vein thrombosis	O	X	X
Hepatic artery thrombosis	X	O	X
Cellular rejection	X	X	X
Humoral rejection	X	O	O
Outcomes	Dead (23 days)	Alive (24 months)	Alive (9 months)

ABO-In, ABO incompatible; ALF, acute liver failure; GV, graft volume; IVIG, i.v. immunoglobulin; LDLT, living donor liver transplantation; MELD, model for end stage liver disease; SLV, standard liver volume.

ABO-In LT has developed in different ways in Western and Eastern countries. Quadruple immunosuppression with splenectomy and plasma exchange improved the outcomes in Western countries, whereas portal infusion treatment in LDLT achieved the same end in Eastern countries [1–3]. Thereafter, the emergence of rituximab has, from its inception onwards, changed the strategy for ABO-In LTs over the world [2–4]. Usui *et al.* [4] reported that the administration of rituximab 3 weeks before LDLT completely suppressed rebound elevation of

iso-agglutinin titer after LDLT. However, another report showed that rituximab given within a week before LT could not control it [2].

Intravenous immunoglobulin may have a significant potential in ABO-In LT for ALFs, for which the promising agent 'rituximab' cannot be given long before LT. For treating humoral rejection, Urbani *et al.* [5] reported in this journal that the use of IVIG at the dose of 1.0–1.5g/kg/daily for 2 weeks for ABO-In LT resulted in successful outcome. In our third patient, iso-agglutinin titer elevated tremendously despite the pre-LDLT rituximab. IVIG was given at the dose of 0.6g/kg for the rebound, resulting in its successful regression.

We completely agree with Toso *et al.* [1] that the outcomes in ABO-In LT have become acceptable, even in cases where the same has been indicated for ALF. Moreover, not only rituximab, but also IVIG might be important key agents for performing successful ABO-In LT. Further presentations covering such cases are strongly commended.

Toru Ikegami, Yuji Soejima, Akinobu Taketomi,
Tomoharu Yoshizumi and Yoshihiko Maehara
Department of Surgery and Science,
Graduate School of Medical Sciences,
Kyushu University,
Fukuoka, Japan

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