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Health Care Organisation

ANAESTHESIA FOR LIVER TRANSPLANTATION

TWELVE YEARS OF LIVER TRANSPLANTATION EXPERIENCE IN A KAUNAS (LITHUANIA) CLINIC: AN ANAESTHESIOLOGIST'S PERSPECTIVE

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Since the first liver transplantation at the Kaunas Clinic of the Hospital of Lithuanian University of Health Sciences (LUHS), in 2000, many changes have been implemented and an increasing number of cases led to the development of expertise. The aim of this article was to summarise 12-years out of liver transplantation experience. Data was obtained retrospectively from inpatient medical records at the Hospital of LUHS, Kaunas Clinic. All cases of liver transplantations from November 2009 to September 2021 were included (n = 96). The median age of transplant recipients was 50 years (IQR 46–56). Two-thirds of recipients were male (n = 66, 69%). The mean Model for End-Stage Liver Disease (MELD) score was 23 (SD 6). The most common indication for liver transplantation was hepatitis C virus-related end-stage liver disease (n = 24, 25%). Immediate extubation was performed with a median of 63% of cases (IQR 14.3–75.7%). We further compared data between the early (November 2009 – December 2015) and late phases (January 2016 – September 2021) of experience: the number of liver transplantation cases increased by 66% from 36 to 60), MELD scores stayed similar (an average of 22 vs 24, p *= 0.282), and mean intraoperative time did not change significantly (543 minutes vs 496 minutes,* p *= 0.078). Liver transplantation has been gaining momentum in Lithuania. Increasing experience enables our centre to meet an increasing demand for liver transplantations.*

Keywords: *single centre experience, adult liver transplantation.*

INTRODUCTION

Since the first case of liver transplantation in 1967, it has rapidly improved and become the standard treatment for acute liver failure and end-stage liver disease of all aetiologies (European Association for the Study of the Liver, 2016). The first successful case of liver transplantation in the Kaunas Clinic of the Hospital of Lithuanian University of Health Sciences (LHUS) was performed in 2000. Unfortunately, the patient died 13 days later (Pundzius *et al*., 2001). During the following nine years, very few liver transplantations were performed. However, since 2009, when the decision to become a transplantation centre was made, many changes were implemented by the anaesthesiologist team, such as the use of new anaesthetic equipment, protocolised intraoperative management, immediate extubation, and postoperative treatment protocols. The development of expertise resulted in an increasing number of cases during the following years. The aim of this article was to summarise the 12 years of liver transplantation experience at the Kaunas Clinic of the Hospital of LUHS since the beginning of the transplantation programme in 2009.

DATA COLLECTION AND ANALYSIS

The data was obtained retrospectively from inpatient medical records at the Kaunas Clinic, Hospital of LUHS. All cases of liver transplantations from deceased donors, including retransplantations, were included.

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For further analysis, two phases of the transplantation programme were compared: the first phase represents the early stages of the transplantation programme and includes cases from November 2009 to the end of 2015 (n = 36), and the second phase includes all cases from January 2016 to September 2021 (n = 60).

Descriptive statistics were calculated for all variables. The normality of variables was assessed using the Shapiro–Wilk test. Normally distributed variables are reported as mean and standard deviation (SD), non-normally distributed variables are reported as median and interquartile range (IQR). The Student's t-test was used to evaluate differences. A p-value < 0.05 was considered statistically significant.

OUTCOMES

From 2009 to September 2021, a total of 96 liver transplantation surgeries were performed, eight of which were re-transplantations. The median age of transplant recipients was 50 years (IQR 46–56), with a range of 19–70 years at the time of the surgery. 66 (69%) recipients were male and 30 (31%) were female. The mean MELD score was 23 (SD 6), with a range of 8–39. The most common indications for liver transplantation were hepatitis C virus-related end-stage liver disease (n = 24, 25%), followed by cryptogenic cirrhosis (n = 23, 24%) and hepatocellular carcinoma with or without hepatitis B or hepatitis C (n = 19, 19%) (Table 1). Sixteen patients required additional interventions after the initial surgery. Twelve surgical revisions were done, the majority of which were due to vascular complications (n = 8, 67%) (Table 2). No immediate extubations were performed from 2009 to 2011; therefore, rates of immediate extubation were evaluated from 2012, when an immediate extubation protocol was implemented. The median rate of immediate extubation was 63% (IQR 4.3–75.7%) (Fig. 1). Further analysis of data showed that in the early stage of the transplantation programme, 36 surgeries were performed, with an average of four to five cases per year. From January 2016 to September 2021 the number of surgeries rose rapidly, with a total of 60 cases and an average of ten cases per year. Patient selection remained similar, with MELD scores averaging 22 before 2016 and 24 during the later stage (p = 0.282). The intraoperative time tended to shorten from 543 minutes (SD 114 min) to 496 minutes (SD 101 min), although this was not statistically significant (p = 0.078).

CONSIDERING THE PAST AND THE FUTURE

The first team of anaesthesiologists specialising in liver transplantation consisted of four physicians who underwent training in the Groningen Institute for Organ Transplantation in the Netherlands, a high-volume transplantation centre that conducts extensive research and where the liver transplantation programme was implemented more than 40 years ago. The anaesthesiologists underwent training in Ghent University Hospital (Belgium) and Essen University Hospital (Germany) as well.

Table 1. Aetiology of end-stage liver disease

HCV related liver disease	24
Cryptogenic cirrhosis	23
HCC with or without HCV/HCB	19
Retransplantation	8
Primary sclerosing cholangitis	6
Toxic cirrhosis	4
Wilson's disease	4
Primary biliary cirrhosis	3
HBV related liver disease	2
Autoimmune cirrhosis	1
Drug-induced hepatitis	1
Alcoholic toxic cirrhosis	1

Table 2. Aetiology of revisions

Hepatic artery thrombosis	3
Bile duct stricture	3
Vascular anastomotic leakage	2
Portal vein thrombosis	1
Celiac trunk stenosis	1
Eventration	1
Intestinal perforation	1
Bleeding	1

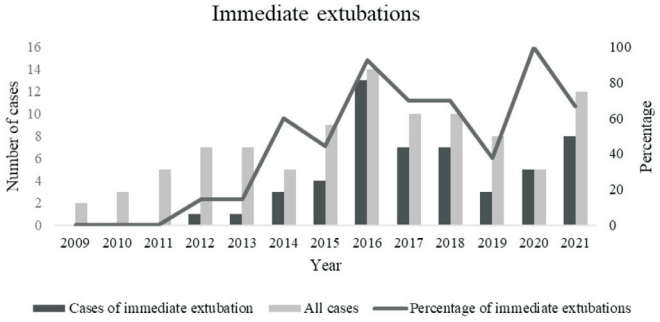


Fig. 1. Number of immediate extubations.

Substantial evidence points to the association between immediate extubation and enhanced recovery. Therefore, immediate extubation was implemented early in our practice, with the first case in 2012. In a recent meta-analysis, it was shown that immediate tracheal extubation is associated with shortened times of treatment in the ICU, shorter hospitalisation, lower rates of morbidity and mortality, and fewer transplant dysfunction (Li *et al*., 2018). Protocolised decision-making on whether to proceed with extubation in the operating room allowed us to increase the number of successful cases, and consequently, in 2020, an immediate extubation rate of 100% was achieved. It must be noted that immediate extubation is not always possible due to factors related to the patient and the case itself, and therefore, we do not aim to accomplish rates of 100%, and consider some deviation as acceptable. In addition, multiple modalities that constitute part of routine care have been implemented

throughout the years to provide the best anaesthesiologic management, such as a rapid infusion system, thromboelastography, and advanced haemodynamic monitoring using a PiCCO system, which is important considering that our centre is resource-limited and the experience so far has been relatively short. Protocols for anaesthesia management during main liver transplantation surgery stages were implemented as well. Since the advent of transplantation anaesthesiology in Kaunas, many new physicians have been trained and have joined the team. An experienced supervisor is available at all times and can aid every anaesthesiologist in the decision-making process.

In other transplant centres, MELD scores have been reported as averaging 18–20, except in USA and Germany (Trotter, 2017). In comparison, we report a similar average of 23. The leading indication for transplantation in our centre was hepatitis C virus-related liver disease, followed by hepatocellular carcinoma, which is consistent with trends in Europe (Adam *et al*., 2018). However, with recently improved antiviral treatment of HCV, a shift in aetiologies is expected, as observed in the USA, where HCV has been surpassed by non-alcoholic steatohepatitis (NASH) and alcoholic liver disease (Parrish *et al*., 2019). The high numbers of cryptogenic cirrhosis cases observed could be explained by the fact that the two aetiologies mentioned above sometimes are coded under cryptogenic causes of end-stage liver disease in Lithuania, due to reasons related to social issues and diagnostic difficulties because many patients seek evaluation and treatment when already with cirrhosis.

Early outcomes have been improving in recent years, with 90 days and 1-year survival being reported in the 90% range (Baganate *et al*., 2018). It has been argued that outcomes are related to the yearly caseload, with higher-volume centres demonstrating better survival (Axelrod *et al*, 2004). However, with organ allocation based on the MELD score, after adjusting for multiple factors, the volume of a transplant centre was not a significant predictor of survival (Northup *et al*, 2006). In addition, low-volume centres have demonstrated excellent outcomes. In Chang Gung Memorial Hospital-Kaohsiung Medical Centre, in 10 years, 53 cases were performed and 1-year survival increased from 88.46% to 97.67% (Chien *et al*, 2005). Thus, lower volume centres are rapidly improving patient outcomes. Even though analysis of survival was out of the scope of this article, we aim to achieve similar results in the Hospital of LUHS, Kaunas Clinic.

Consistent with other countries, the demand for organ transplantation has been increasing and is much higher than the number of transplantations that are done. Approximately, 10 to 11 people die each day while waiting for organ transplantation (Vanholder *et al.*, 2021). At the time this article was written, 101 patients, of which 62 were temporarily not eligible, were on the waitlist for liver transplantation in Lithuania. Despite that, the number of surgeries performed yearly rarely surpasses 20 and does not meet the demand (National Transplant Bureau under the Ministry of Health, 2021c). Organ donation-related issues contribute to the low number of liver transplantations. The current policy of organ donation is improving. In Lithuania, only around 37 thousand people have a donor's card that proves an individual's consent to donate his organs after death (National Transplant Bureau under the Ministry of Health, 2021b). Therefore, the majority of organ donations can be performed only after obtaining the consent of a family member and approximately a third of relatives have refused to give consent during the past 15 years. The number of effective donors in Lithuania in the last 15 years almost doubled, with a major surge observed in 2016 — a year after a non-heart-beating donation was implemented, with 21.03 effective donors per million. After that, the rates have declined, but from 2009 to 2019 Lithuania was among 43% of European countries that managed to increase donation rates (Vanholder *et al*., 2021; National Transplant Bureau under the Ministry of Health, 2021a). Hopefully, this positive trend will continue, and organ shortage in Lithuania will decrease. In this way, more patients will be able to benefit from liver transplantation.

CONCLUSIONS

Liver transplantation is a life-saving procedure for patients with end-stage liver disease, and it has been gaining momentum in Lithuania. Even though the liver transplantation programme was implemented in the 1990s, a consistent case flow was achieved only 15 years later. With the implemented changes, protocolised care, and increasing experience, our centre is expected to be able to meet increasing demand for liver transplantations.

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ANESTĒZIJA AKNU TRANSPLANTĀCIJĀ. DIVPADSMIT GADU AKNU TRANSPLANTĀCIJAS PIEREDZE KAUŅAS (LIETUVA) KLĪNIKĀ: ANESTEZIOLOGA PERSPEKTĪVA

Kopš pirmās aknu transplantācijas Lietuvas Veselības zinātņu universitātes (*Lithuanian University of Health Sciences, LUHS*) slimnīcas Kauņas klīnikā 2000. gadā ieviestas daudzas pārmaiņas, un arvien lielāks operāciju skaits pilnveidojis kompetenci šajā jomā. Raksta mērķis bija apkopot 12 gadu aknu transplantācijas pieredzi. Dati iegūti retrospektīvi no *LUHS* slimnīcas Kauņas klīnikas stacionāra medicīniskajiem dokumentiem. Tika iekļauti visi aknu transplantācijas gadījumi no 2009. gada novembra līdz 2021. gada septembrim (n = 96). Transplantācijas saņēmēju vidējais vecums bija 50 gadi (IQR 46–56). Divas trešdaļas saņēmēju bija vīrieši (n = 66, 68,75%). Vidējais *MELD* (*Model for End-Stage Liver Disease*, Gala stadijas aknu slimību modelis) rādītājs bija 23 (SD 6). Visbiežāk sastopamā aknu transplantācijas indikācija bija ar C hepatīta vīrusu saistīta beigu stadijas aknu slimība (n = 24, 25%). Tūlītēja ekstubācija tika veikta vidēji 63% operāciju (IQR 14,3–75,73 proc.). Tālāk mēs salīdzinājām datus starp agrīno (2009. gada novembris – 2015. gada decembris) un vēlīno fāzi (2016. gada janvāris – 2021. gada septembris): aknu transplantācijas gadījumu skaits palielinājās par 66% no 36 līdz 60, MELD rādītāji palika līdzīgi (vidēji no 22 pret 24, p = 0,282), un vidējais operācijas laiks būtiski nemainījās (543 minūtes pret 496 minūtēm, p = 0,078).