

History of liver transplantation in Poland

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ABSTRACT:

Experimental research on liver transplantation was introduced in Poland by Waldemar Olszewski and his team in 1972. Not until 15 years later, in 1987, did Stanisław Zieliński in Szczecin and Marian Pardela in Katowice make an attempt of transplanting liver in humans. In 1989 another attempt was made by Jacek Pawlak and Marek Krawczyk in Warsaw. The first successful liver transplantation in Poland was performed in 1990 by Piotr Kaliciński at the Children's Memorial Health Institute, Warsaw. Also, in early 1990s the attempts were made by Jerzy Polański in Warsaw and Piotr Szyber in Wrocław. In the next years, liver transplantations were connected with three centers in Szczecin and were associated with the following persons: Roman Kostryka, Maciej Wójcicki and Samir Zeaira. In Warsaw, 1994, Jacek Pawlak, Bogdan Michałowicz and Krzysztof Zieniewicz performed another successful liver transplantation. The program started to develop rapidly and is still up and running. In 2000, Wojciech Rowiński and Marek Pacholczyk created another liver transplant center in Warsaw, while in 2005 Lech Cierpka and Robert Król did the same in Katowice. In the following years, liver transplantation was initiated by Maciej Stupski in Bydgoszcz (2017) and Zbigniew Śledziński in Gdańsk (2018). In the developing liver transplant centers, an exceptional contribution was made by Paweł Nyckowski, Jacek Pawlak, Krzysztof Zieniewicz, Waldemar Patkowski, Tadeusz Wróblewski, Rafał Paluszkiwicz, Marek Pacholczyk, Andrzej Chmura, Maciej Kosieradzki and Marek Krawczyk – all employed by the Medical University of Warsaw. In Wrocław, Dariusz Patrzalek and Paweł Chudoba were very active in the field of liver transplantations. In 1996, the Organizing-Coordinating Center for Transplantation POLTRANSPLANT was brought to life and at first was directed by Janusz Wałaszewski, then by Roman Danielewicz and Artur Kamiński. In 1999, Piotr Kaliciński and Marek Krawczyk started the program for liver fragment harvesting and transplantation from living donors. Until the end of 2016, 4186 liver transplantations including 314 liver transplants from living donors were performed in Poland. Currently there are three active centres in Warsaw, namely Pediatric Surgery and Transplantation Surgery, Children's Memorial Health Institute; Department of General, Transplant and Liver Surgery, Medical University of Warsaw; Department of General and Transplant Surgery, Medical University of Warsaw. Other active centres in Poland are Department of General and Transplant Surgery, Provincial Hospital in Szczecin, Department of General, Vascular and Transplant Surgery, Medical University of Silesia, Katowice, Department of Vascular, General and Transplant Surgery in Wrocław. Liver transplant programs have also been initiated at the Department of Liver and General Surgery, Bydgoszcz, and Department of General, Endocrine and Transplant Surgery, Medical University of Gdańsk.

KEYWORDS: liver transplantations, history of liver transplantation, liver transplant centers in Poland, liver transplantation technique

INTRODUCTION

First experimental research on liver transplantation was conducted by C.S. Welch in 1955 [1], who performed a heterotopic liver transplantation as an accessory organ in dogs (Fig. 1).

First operations, including experimental orthotopic liver transplantation, were performed in late 1950s and early 1960s by Thomas E. Starzl, who proposed a type of operation used until now in clinical transplantology (Fig.2) [3,4].

Following experimental research in 1963, Thomas Starzl performed five unsuccessful liver transplantations on humans [5]. Not until 1967 did he perform the very first successful liver transplantation due to hepatocellular carcinoma, which led to a 400-day patient survival [6]. Unfortunately, 3 months after the surgery, the cancer relapsed in the transplanted organ. It was the tenth liver transplantation in the world [7].

At the same time, Sir Roy Calne in Cambridge (1968) as well as Henri Bismuth in Paris, Rudolf Pichlmayr in Hannover and Rudi Krom in Groningen (1970s) were conducting their research on liver transplantation in Europe [2].

According to clinical and technical standards of that time, removing one organ and replacing it with another was a procedure with minimal chances for success. Over time, the procedure started to

resemble the surgical technique used nowadays. It is now hard to imagine that the forerunners started performing transplantations without hemodynamic, biochemical or coagulation monitoring, adequate transfusions or basic, in modern sense, surgical instruments such as atraumatic vascular sutures.

On June 23rd, 1983, on a conference in Bethesda, USA, the American and European experiences were summarized and a consensus was presented, in which it was stated that liver transplantation in patients with end-stage liver failure is no longer an experimental but rather approved treatment [2].

Since then, an enormous progress has been made in this field. Among factors that transformed liver transplantation from an experiment into clinic practice, the revolutionary changes in anesthesiology should be mentioned, especially with respect to hemodynamic monitoring, hemostasis control, monitoring and correcting renal function, metabolism and body temperature. Progress in surgical instruments has also played an important role, particularly in hemostasis control. Another revolutionary factor was an introduction of extracorporeal venous circulation with heparinized catheters. Applying of transplantation technique maintaining continuity of the inferior vena cava (so called piggy-back operation) was another milestone. Also, we should mention retractors for operative field exposure. Before their introduction, most recipients required opening of the abdominal cavity and left pleura in order to provide access to the inferior vena cava above the liver [8,9].

Roy Calne's research was important not only for liver surgery but also for application of a new immunosuppressive agent – cyclosporine, which made a revolutionary improvement in liver transplantation outcomes [10]. The use of cyclosporine increased the 5-year survival of recipients up to 70%, while tacrolimus – even to 80% [2].

HISTORY OF LIVER TRANSPLANTATION IN POLAND

In 1972, Waldemar Olszewski with co-authors presented the very first in Polish literature report on liver transplantation [11]. Their research focused on experimental work on dogs and included organ storage evaluation as well as transplant rejection symptoms. The paper was published only five years after the first successful liver transplantation in the world [6], four years after the first successful liver transplantation in Europe [12] and three years after discovering an immunosuppressive agent, cyclosporine, by Jean Francis Borel [13]. Original conclusions drawn by Olszewski pointed to raised bilirubin concentration as the most characteristic marker of liver transplant rejection. High bilirubin level suggests irreversible liver injury and it is usually too late for an appropriate immunosuppressive treatment.

The next article by the same authors was published by the Polish Journal of Surgery also in 1972, in which the harvesting and orthotopic liver transplantation in dogs were presented [14].

On the original illustrations in that chapter, the authors presented liver harvesting (Fig. 3-5).

Summarizing their research, the authors stated: '(...) some modifications of the technique aimed at making it as similar to clinical conditions as possible, including liver harvesting from a dead animal 15 minutes after its death, not administering heparin to the donor, constant cooling of the liver with cool perfusion during anastomosis formation etc. (...)'. Today, 45 years after those publications, it is hard to explain why the research was not continued.

As part of clinical research, first unsuccessful liver transplantations in Poland were performed by Stanisław Zieliński, 03.12.1987 in Szczecin (Fig. 6) (the patient died soon after the surgery) and Marian Pardela, 10.12.1987 in Katowice (the patient died after 8 days).

Altogether Marian Pardela with his team performed a total of 9 liver transplantations with the longest survival 185 days.

At our department on December 8th, 1989, Jacek Pawlak and Marek Krawczyk with their team performed an unsuccessful liver transplantation.

Discussing liver transplantation in Szczecin, other brilliant surgeons should be mentioned who contributed to developing of this form of treatment in patients with end-stage liver failure, namely Roman Kostryka, Maciej Wójcicki and Samir Zeair. Those surgeons were heads of different wards where transplantation was performed.

The period from late 1980s to early 1990s was important for Polish surgeons, because many of them were being trained abroad in foreign transplantation centers. It resulted in founding liver transplantation centers in Poland in early 1990s. The first successful liver transplantation in Poland took place on March 1st, 1990, at the

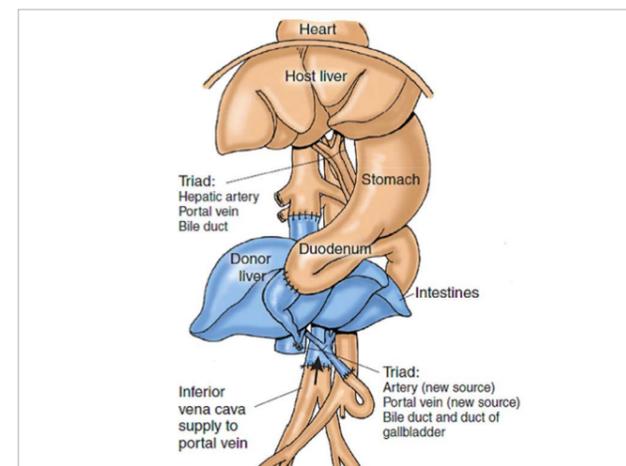


Fig. 1. Heterotopic liver transplantation according to C. Stuart Welch, 1955. The illustration comes from: Starzl T.E.: The long reach of liver transplantation. Nature Medicine. 2012, 18, 1–4 [2].

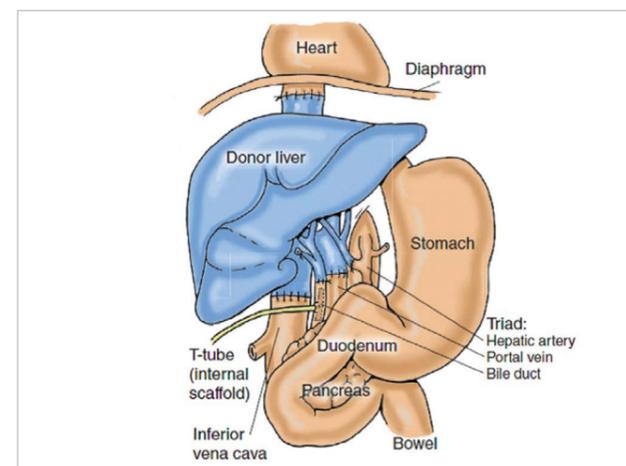


Fig. 2. Orthotopic liver transplantation according to T. Starzl, 1960. The illustration comes from: Starzl T.E.: The long reach of liver transplantation. Nature Medicine. 2012, 18, 1–4 [8].

Department of Child and Transplant Surgery, Children's Memorial Health Institute, Warsaw. It was performed by Piotr Kaliciński (Fig. 7) in cooperation with Rudolf Pichlmayr from Hannover.

Jerzy Polański who also made his contribution to the development of liver transplantation in Poland performed his first liver transplantation in the hospital at Stępińska Street in Warsaw on November 11th, 1991. The total number of transplantations performed at this hospital was 7 and the longest survival was 3 months.

Wrocław was another center where liver transplantation was initiated; Piotr Szyber performed the first liver transplantation there on May 3rd, 1993. At that center, Dariusz Patrzalek was also very active in the field. In the recent years, liver transplantation in Wrocław has been associated with Paweł Chudoba.

Over the next years, liver transplantations were performed at various centers. Wojciech Rowiński with his team initiated liver transplantation program at the Department of General and Transplant Surgery of the 1st Faculty of Medicine, the Medical University of Warsaw in 2000. Great contribution into the development of this technique was made by Marek Pacholczyk and Andrzej Chmura, as

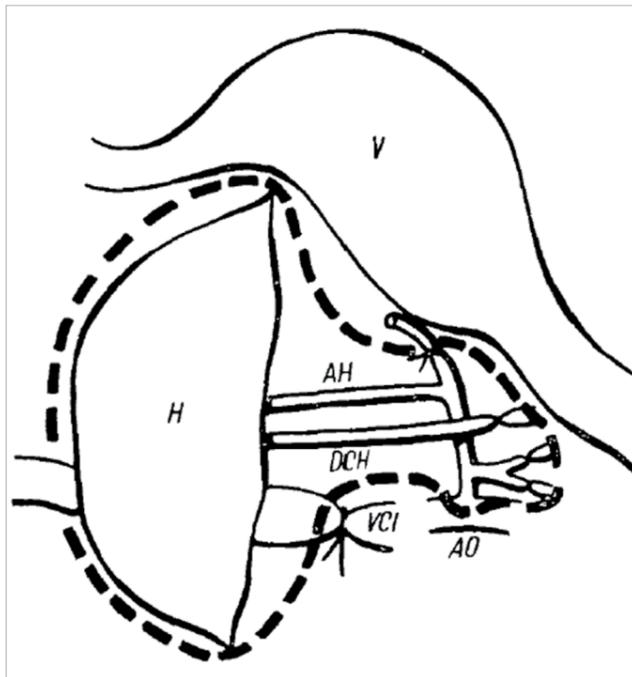


Fig. 3. Separation and transection of blood supply to the liver. AH – hepatic artery, AGD – right gastric artery, DCH – common bile duct, AO – aorta, VCI – inferior vena cava, V – stomach, H – liver. The dashed line indicates sites of liver separation from surrounding structures. Source: Olszewski W., Polański J., Zawadzki A., Sawicki Z., Machowski Z., Muszyński M.: Technika pobierania i ortotopowego przeszczepienia wątroby u psów. Pol. Przegl. Chir. 1972; 44, 95–101 (14).

well as the current head of the department Maciej Kosieradzki. Until June 2017, 577 liver transplantations had been performed in total.

In 2005, Leszek Cierpka started a liver transplantation program at the Department of General, Vascular and Transplant Surgery at Silesian Medical University. Nowadays, the department is directed by Robert Król. Until June 2017, 296 liver transplantations were performed there.

Discussing the history of liver transplantation in Poland, it should be mentioned that the Minister of Health and Social Care issued the permission for liver transplantation for the Department of General, Endocrine and Transplant Surgery, Medical University of Gdańsk. Liver transplantations have been done there since 2018.

A new developing center is the Department of Liver and General Surgery, Collegium Medicum, Nicolaus Copernicus University in Toruń. The department is located in Bydgoszcz and directed by Maciej Słupski. In 2017, a few liver transplantations were performed there.

The biggest liver transplantation center in Poland is the Department of General, Transplant and Liver Surgery, Medical University of Warsaw. The first unsuccessful surgery in 1989 prompted for better preparation for transplantation program. In 1990, the surgical team started a long-term training at various foreign transplant centers, mainly in France.

The training project in France was commenced by Paweł Nyckowski (Fig.8), who organized a series of visits of Polish surgeons to a prestigious liver transplantation center in Villejuif near Paris (head: Henri Bismuth). Paweł Nyckowski's first trip in 1990 was

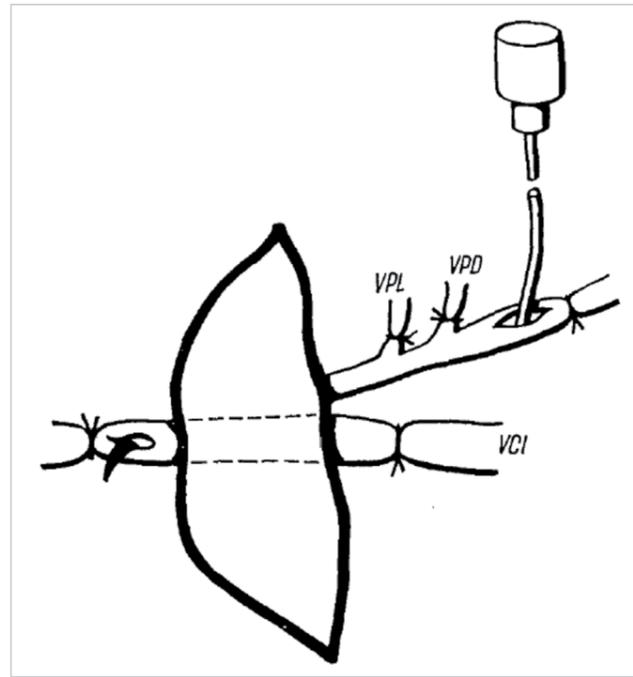


Fig. 4. Liver cooling. VP – portal vein, VPD – pancreaticoduodenal vein, VCI – inferior vena cava, VPL – right gastric vein. Source: Olszewski W., Polański J., Zawadzki A., Sawicki Z., Machowski Z., Muszyński M.: Technika pobierania i ortotopowego przeszczepienia wątroby u psów. Pol. Przegl. Chir. 1972; 44, 95–101 (14).

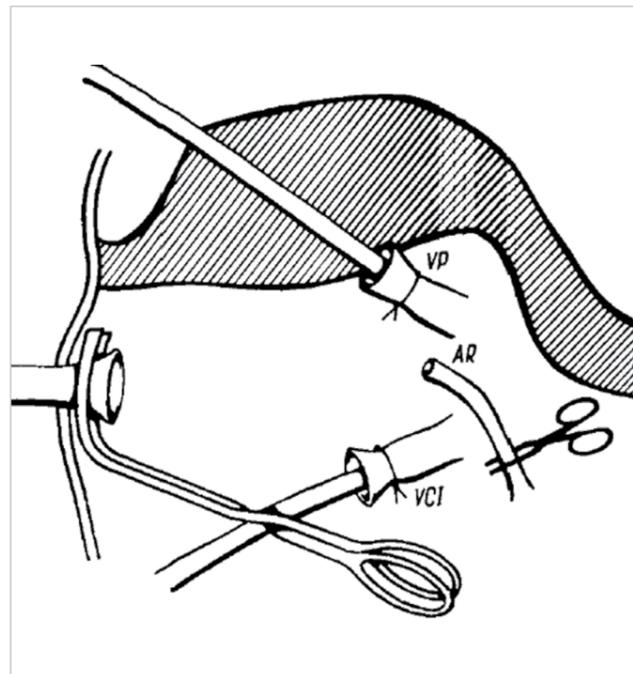


Fig. 5. Post-hepatectomy status. The inferior vena cava is clamped beneath the diaphragm. Four vessels are ready for anastomosis: inferior vena cava (above and below the liver), portal vein and renal artery. Source: Olszewski W., Polański J., Zawadzki A., Sawicki Z., Machowski Z., Muszyński M.: Technika pobierania i ortotopowego przeszczepienia wątroby u psów. Pol. Przegl. Chir. 1972, 44, 95–101 (14).

made possible by L'Association Le Pont Neuf (directed by Mrs President Bernadette Chirac). Thanks to that foundation, also Krzysztof Zieniewicz and Paweł Paczkowski had an opportunity to participate in the project.

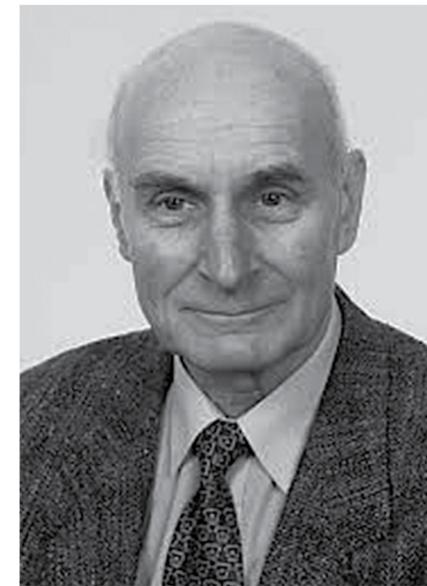


Fig. 6. Professor Stanisław Zieliński.



Fig. 7. Professor Piotr Kaliciński.



Fig. 8. Professor Paweł Nyckowski.



Fig. 9. The patient (the second person sitting from the left) with the surgical team 20 years after transplantation.

On December 30th, 1994, the surgical team of the Department of General, Transplant and Liver Surgery, Medical University of Warsaw (named back then the Department of General and Liver Surgery, Medical Academy in Warsaw) including Jacek Pawlak, Bogdan Michałowicz and Krzysztof Zieniewicz transplanted the liver in a patient who survived 28 years in good health. On the photograph: patient, surgical team, 2014 – 20 years after transplantation (Fig.9).

The training of our team in Villejuif under the auspices of H. Bismuth lasted 4 years. Between 1990 and 1994, 8 surgeons, 2 anesthesiologists and 1 pathologist took part in the training.

We are still grateful to this brilliant transplantologist, whose contribution to developing transplantology at our hospital is invaluable. The university expressed the gratitude by honouring Henri Bismuth

with the doctor honoris causa title in 2001. The diploma was handed over by our President Professor Janusz Piekarczyk (Fig. 10).

The second center, where our team had been trained in liver transplantology, was Hautepierre Hospital, University of Strasbourg. The transplantation department was directed by a distinguished transplant surgeon Daniel Jaeck. In 1995, Marek Krawczyk, Paweł Nyckowski, Krzysztof Zieniewicz and Waldemar Patkowski were practicing there. It was another great school, where we learned a valuable transplantation lesson. Daniel Jaeck received the highest award a university can give. In 2014 he was awarded doctor honoris causa title by the Medical University of Warsaw (Fig. 11).

Our team members listed above made great contribution to many achievements, however, we must mention two other persons,



Fig. 10. Professor Henri Bismuth after receiving doctor honoris causa diploma at the Medical Academy in Warsaw, 2001.



Fig. 11. Professor Daniel Jacek after receiving doctor honoris causa diploma from the Medical University of Warsaw, 2014.



Fig. 12. First liver harvesting from a living donor. From left: Professor Rafał Paluszkiwicz, Professor Marek Krawczyk, Professor Olivier Farges, Professor Krzysztof Zieniewicz.



Fig. 13. The moment right before implantation of segments II and III harvested from the father. From left: Professor Piotr Kaliciński, Professor Yann Revillon.

namely Professor Jerzy Szczerbania and Professor Andrzej Karowski, who supported us with their experience and knowledge at each stage of the program despite not performing liver transplantation on their own.

The team of the Department of General, Transplant and Liver Surgery were trained at other centers as well. Paweł Nyckowski and Krzysztof Zieniewicz had the opportunity to gain experience in Bordeaux (head: Jean Saric) and Rennes (head: Karim Boudjema). Waldemar Patkowski spent a couple of months in the hospital in Tokyo (head: Koichi Tanaka), while Piotr Remisz – in Charite Hospital in Berlin (head: Peter Neuhaus).

On October 12th, 1999, the next stage in Polish transplantology opened – harvesting and transplanting liver transplants from living donors. At the Department of General, Transplant and Liver Surgery, Medical University of Warsaw, segments II and III were harvested from the child's father. In addition to Marek Krawczyk, Rafał Paluszkiwicz and Krzysztof Zieniewicz, Oliver Farges from Hôpital Beaujon in France took part in the surgery (Fig. 12). At the Department of Child Surgery and Organ Transplantation, Children's Memorial Health Institute, Piotr Kaliciński and Yann Revillon from the Children's Hospital in Paris performed liver fragment transplantation (Fig. 13). An important part in starting the program was also played by Andrzej Kamiński. The program gave a chance to many children, who probably would have never received liver transplant from deceased donors.

After gaining the experience in harvesting left lobe fragments, in

2001 Marek Krawczyk with the team performed the first transplantation of right lobe fragments from an adult donor. Although the number of procedures that have been performed so far is rather small, most of them were successful in majority of recipients (with no complications in donors either).

It should be mentioned that in the development of liver transplantation in Poland, the creation of POLTRANSPLANT in 1996 under the auspices of the Ministry of Health played a vital role. A long-term director of POLTRANSPLANT and its creator was Janusz Wałaszewski, the next director was Roman Danielewicz, and currently the position is held by Artur Kamiński.

POLTRANSPLANT, the Organizing-Coordinating Center for Transplantation, is a public state-financed organization under the authority of the Minister of Health located in Warsaw. POLTRANSPLANT has many functions, but the most important one is to promote and organize collecting, storing and transplanting cells, tissues and organs.

The next important event in organizing organ transplantation in Poland was calling into existence the post-graduate program for transplantation coordinators carried out by the Medical University of Warsaw in spring 2007. The program was initiated and designed by the Polish Union for Transplantation Medicine, and the leading person was Wojciech Rowiński. The aim of the program is to educate transplant coordinators for each hospital in the country. So far, 18 editions of the program have been carried out, with 30 participants in each session. It can be said that an enormous

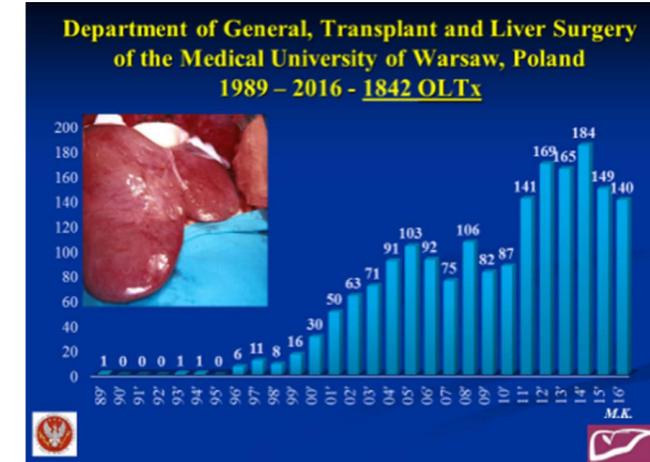


Fig. 14. Number of liver transplantations performed at the Department of General, Transplant and Liver Surgery, Medical University of Warsaw. Over the years 1989 – 2016 1842 liver transplantations were performed.

work of the whole transplantation community brought good results as because 8.1 collections per 1 mln citizens were registered in 1990 and in 2017 the number raised to 14.7 collections per 1 mln citizens. Still, there are huge differences between regions in Poland. Most collections are registered in West Pomeranian (Zachodniopomorskie) and Greater Poland (Wielkopolskie) voivodeships. There is still much work to do.

An important issue is the system of donor allocation. It is the so-called 1 + 1 + 1 + 1 + 1 etc. system. It means that when POLTRANSPLANT receives information about a deceased donor, it conveys this information to a transplantation center. With the next report, the next center on the list receives this information and so on until the list starts again.

Currently, there are 7 centers for liver transplantation in Poland. The only one performing such procedures in children is the Department of Child and Transplant Surgery, Children's Memorial Health Institute. It was at that center where Piotr Kaliciński with his team performed the first successful liver transplantation. Until 1999, the center based its program on deceased donors. It was necessary to reduce the size of an adult liver (so-called reduced liver transplantation) in order to use it in a child. Since 1999, when liver fragment transplantation program from living donors was commenced, the number of deceased donor transplantations or alternatively from living donors has been sufficient for child transplantations in Poland.

One of the longest-active centers of liver transplantation in Poland is in Szczecin. Its history was difficult. After pioneer surgeries by Stanisław Zieliński, the chief transplantologist was Roman Kostyrka. He was an extremely devoted physician, however... he was unable to create a transplantation team. At his peak activity, he harvested liver from the donor, performed hepatectomy and implanted the liver in the recipient - all by himself. He did not use the biopump during transplantation, but he did perform portacaval anastomosis when it was reasonable. The first successful liver transplantation in Szczecin was performed by Kostyrka in 1996 at the Department of General and Transplant Surgery, Pomeranian Medical Academy (today: Pomeranian Medical University) headed by Professor Stanisław Zieliński. Kostyrka, in his pione-

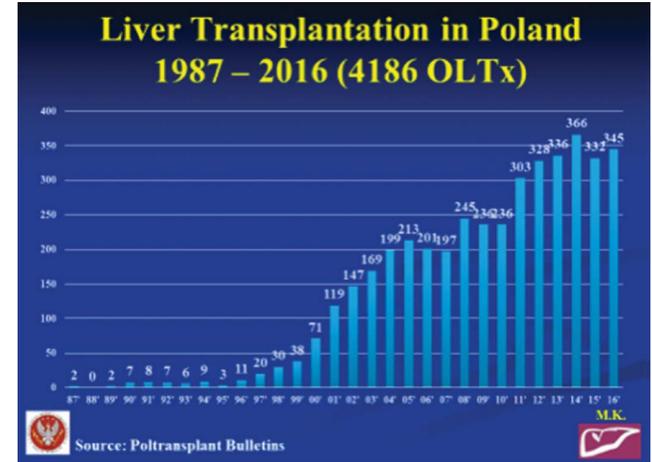


Fig. 15. Number of liver transplantations in Poland over the years 1987 – 2016.

er years, performed 80 liver transplantations in Szczecin working at three successive hospitals, i.e. the Department of General and Transplant Surgery, Powstańców Wlkp. Street (48 surgeries); Department of General and Transplant Surgery, Independent Public Province Hospital, Arkońska Street (9 surgeries); Liver and Biliary Tract Surgical Unit, Department of Gastroenterology, Pomeranian Medical University, Unii Lubelskiej Street (23 surgeries).

An impressive development of liver transplantation center in Szczecin took place in 2002 on return of Maciej Wójcicki from training abroad. At that time, there were two liver transplantation centers operating in Szczecin. Maciej Wójcicki, who was the head of Liver, Pancreas and Liver Transplant Surgery Unit, Department of General and Transplant Surgery, knew perfectly well how to use the experience gained from Maarten Sloof in Groningen, Netherlands. The number of liver transplantations increased immensely, and the outcomes were perfect. After Maciej Wójcicki, the center was directed by Samir Zeair. He is an outstanding transplantologist, who also has his great share in successes of the Szczecin center. By the end of 2016, a total of 707 liver transplantations were performed there.

Another center of liver transplantation, operating since 1993, is the Department of Vascular, General and Transplant Surgery, Medical University in Wrocław. It is headed by Piotr Szyber, although in development of transplantation there, the enormous contribution was made by Dariusz Patrzalek, who was not only active in liver transplantation itself but also in promoting organ transplantation resulting in an increasing number of multiorgan collection from deceased donors in the region. In recent years, Paweł Chudoba has been responsible for the program, now he is also the current Head of the Transplantation Council in the Ministry of Health. Until the end of 2016, 81 liver transplantations were performed there.

As concerns the Medical University of Warsaw, very good liver transplantation outcomes are achieved also at the Department of General and Transplant Surgery. The main credit is to Wojciech Rowiński, who in 1981 created the Department of General Surgery, Infant Jesus Teaching Hospital, which was later converted into the Department of General and Transplant Surgery. For the first years, the surgical team was preoccupied with kidney transplantation, and later with pancreas transplantation as well. In 2000, on

return of Marek Pacholczyk from a two-year internship in Groeningen, Netherlands, liver transplantation was commenced based on well-managed program. Significant contribution was made by the two subsequent directors Andrzej Chmura and Maciej Kosieradzki as well as Beata Łągiewska in recent years. Until the end of 2016, 577 liver transplantations from deceased donors were performed at the Department of General and Transplant Surgery.

In 2005, Leszek Cierpka, the head of the Department of General, Vascular and Transplant Surgery, Silesian Medical University in Katowice, started liver transplantation program. That center had not been performing neither kidney nor pancreas transplantation before. The liver transplantation program did well and the initial outcomes were outstanding. Currently, the department is headed by Robert Król. Until the end of 2016, 296 liver transplantations from deceased donors were performed there.

The head of the Department of Liver and General Surgery, Collegium Medicum, Nicolaus Copernicus University in Toruń, Maciej Słupski, MD, PhD, started another liver transplantation center in Poland in 2017. The number of procedures is small, but the beginning seems promising.

For a couple of years, the Department of General, Endocrine and Transplant Surgery, Medical University in Gdańsk, directed by Zbigniew Śledziński has been preparing to introduce liver transplantation program what led to first transplantations in 2018.

The Department of General, Transplant and Liver Surgery, Medical University of Warsaw, has been cooperating with the Department of Immunology, Transplantology and Internal Medicine directed by Leszek Pączek and located in a different hospital since the beginning of the transplantation program in 2013. Nevertheless, the cooperation was fine and positively influenced liver transplantation program not only in our university but also across Poland. We have always been aware, though, that further development of the program requires a hepatology unit. At the Public Central Teaching Hospital, Banacha Street 1a such unit, as part of the surgical department, was created in 2008 and directed by Urszula Ołdakowska-Jedynak. In 2014, the unit was converted into the independent Department of Hepatology and Internal Medicine, being a part of the Department of General Transplant and Liver Surgery of the 1st Faculty of Medicine, Medical University of Warsaw. The head of the Department has been Piotr Milkiewicz since its formation. This kind of a management 'model' seems optimal for a properly functioning transplantation center.

From 1994 until the end of 2016 at the Department of General, Transplant and Liver Surgery (the head is Krzysztof Zieniewicz since 01/01/2017), 1842 liver transplantations were performed (Fig. 14).

It has already been mentioned that a new era in liver transplantation in Poland started in 1999 by transplanting a liver fragment from a living related donor. Mean annual number of transplantations is about 20, however, it depends on child patient population as it is in this age group that transplantations from living donors take place. Until the end of 2016, 314 of such procedures have been performed and the distribution of the years is shown in Fig. 16.

The development of liver transplantation made it possible to eliminate mortality in children with irreversible liver failure. The

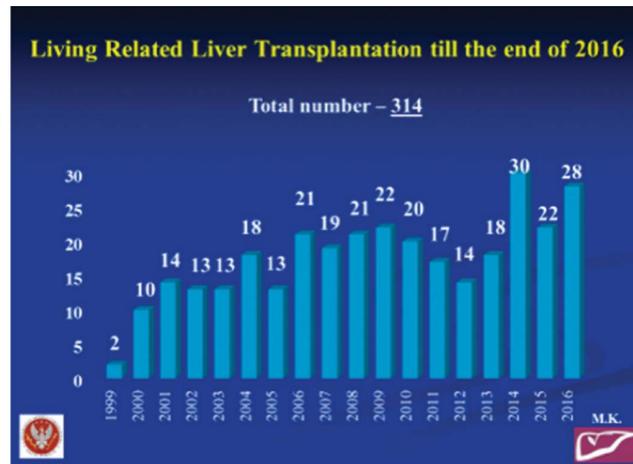


Fig. 16. Number of liver transplantations from living donors in Poland over the years 1999–2016.

child liver transplantation centers have always been associated with surgeons working in two teams – at the Department of General, Transplant and Liver Surgery, Medical University of Warsaw, or the Department of Child and Organ Transplant Surgery, Children's Memorial Health Institute, Warsaw.

Analyzing data on liver transplantation in Poland, three questions arise. Is the number of liver transplantation centers in Poland sufficient? It appears it is not, however, in order to create new centers performing more surgeries, the number of donors should rise as well. If it is not the case, the number of transplantations in big experienced centers will drop, which can result in worse outcomes as it takes time for new centers to gain experience. It leads to the second question – can we expect a rise in the number of transplantations from deceased donors? The answer seems yes, because there are still significant differences between various regions in Poland. If the number of donors increased in regions where there are few donors today then the total number of transplantations should rise as well. The third question regards the demand for liver transplantation in Poland. Comparing our country with others and considering liver morbidity in Poland, the answer seems obvious. The number of liver transplantations in our country should be two times higher, and the impracticability of it is associated with too few donations from deceased donors.

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