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DONIRANJE I TRANSPLANTACIJA BUBREGA, JETRE I SRCA U REPUBLICI SRBIJI ZA PERIOD 2010-2016. GODINE

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SAŽETAK

Uvod/Cilj: Procenjuje se da je 2017. godine izvršeno 139.024 transplantacija solidnih organa (bubreg, jetra, srce, pluća, pankreas i tanko crevo), što je samo 10% globalnih potreba. Cilj ove deskriptivne studije je bio da analizira učestalost doniranja i transplantacija solidnih organa (bubrega, jetre i srca) u Republici Srbiji za period 2010-2016. godine.
Metode: Podaci o broju donora i broju transplantiranih organa u Republici Srbiji, za period 2010-2016. godine, dobijeni su iz godišnjih izveštaja Ministarstva zdravlja Republike Srbije - Uprave za biomedicinu. Podaci o broju stanovnika Republike Srbije preuzeti su iz popisa stanovništva za 2011. godinu. U analizi dobijenih podataka korišćene su proporcije i stope.
Rezultati: U Srbiji je prosečna stopa doniranja, za period 2010-2016. godine bila 3,7 na milion stanovnika. Tokom poslednjih sedam godina među svim obavljenim transplantacijama organa sa umrlih davalaca, najveći procenat su činile transplantacije bubrega (78,3%), a zatim jetre (16,9%) i srca (4,8%). U transplantacionim centrima u Srbiji, za period 2010-2016. godine, obavljeno je 537 transplantacija bubrega, i to 328 sa preminulih i 209 sa živih davalaca. Prosečna stopa transplantacija bubrega (na milion stanovnika), za sedmogodišnji period iznosila je 10,6, odnosno 4,1 kada su u pitanju živi davaoci i 6,5 sa preminulih davalaca. U istom periodu izvršena je 71 transplantacija jetre i 20 transplantacija srca sa preminulih davalaca, a prosečne stope transplantacija su bile 1,4 i 0,4 na milion stanovnika.
Zaključak: U posmatranom periodu, u Srbiji su zabeležene najniže stope transplantacija bubrega sa živih i preminulih davalaca, kao i jetre i srca sa preminulih davalaca, u odnosu na sve druge zemlje Evrope. Oblast transplantacije ljudskih organa u Republici Srbiji pravno je regulisana Zakonom o presađivanju ljudskih organa. Zakonom su utvrđeni i obezbeđeni uslovi za postizanje standarda kvaliteta i bezbednosti ljudskih organa za transplantaciju, uslovi rada i načina organizacije zdravstvenog sistema u cilju obezbeđivanja optimalne dovoljnosti organa za transplantaciju i obezbeđivanje visokog nivoa zaštite ljudskog zdravlja, kao i uvažavanja prioritetnih interesa za očuvanje života i zdravlja i zaštite osnovnih ljudskih prava i dostojanstva davaoca i primaoca ljudskih organa. Poseban akcenat treba staviti na edukaciju stanovništva i zdravstvenih radnika o važnosti doniranja ljudskih organa.

Ključne reči: transplantacija, doniranje, bubreg, srce, jetra

Uvod

Transplantacija ljudskih organa ili delova organa je medicinski postupak uzimanja organa, odnosno delova organa, sa živog ili umrlog lica, zbog presađivanja u telo drugog lica radi lečenja, uključujući sve procedure za pripremu, obradu, očuvanje, praćenje ozbiljnih neželjenih pojava i ozbiljnih neželjenih reakcija, kao i distribuciju organa, odnosno delova organa. Doniranje organa je postupak davanja ljudskih organa sa živog ili umrlog lica radi presađivanja u telo drugog lica radi lečenja, bez novčane naknade (1). Kadaverična donacija ljudskih organa predstavlja uzimanje organa od nedavno preminulog davaoca. Živa donacija ljudskih organa predstavlja doniranje jednog parnog organa (bubreg) ili dela organa (režanj jetre ili pluća) od živog davaoca. Živi davaoci organa su uglavnom u rodbinskoj vezi sa primaocem organa (2).

Danas transplantacija predstavlja najefikasniji oblik lečenja terminalnog stadijuma renalne insuficijencije, kao i jedini dostupan oblik lečenja terminalnog stadijuma obolevanja srca, jetre i pluća (3). Više od milion ljudi širom sveta osetilo je dobrobit nakon uspešno obavljene transplant-

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KIDNEY, LIVER AND HEART DONATION AND TRANSPLANTATION IN THE REPUBLIC OF SERBIA FOR THE PERIOD 2010-2016

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SUMMARY

Introduction/aim: It is estimated that in 2017, 139,024 solid organ transplants (kidney, liver, heart, lungs, pancreas, small intestine) were performed, which is only 10% of global needs. The aim of this descriptive study was to analyze the frequency of donation and transplantation of solid organs (kidney, liver and heart) in Republic of Serbia for the period 2010-2016.

Methods: Data on the number of donors and the number of transplanted organs in Serbia, for the period 2010-2016, were obtained from the Annual reports of the Ministry of Health Republic of Serbia -Directorate of Biomedicine. Data on the population of Serbia were taken from the 2011 census. Proportions and rates were used in the analysis of the obtained data.

Results: In Republic of Serbia, average donation rate, for the period 2010-2016, was 3.7 pmp. During the last seven years, among all performed transplants from deceased donors, the largest percentage were transplants of kidneys (78.3%), followed by liver (16.9%) and heart (4.8%). In transplant centers in Serbia, for the period 2010-2016, 537 kidney transplants were performed, 328 from deceased and 209 from living donors. The average rate of kidney transplants for the seven-year period was 10.6 pmp, or 4.1 pmp for living donors and 6.5 pmp for deceased donors. In the same period, 71 liver transplants and 20 heart transplants from deceased donors were performed, and the average transplant rates were 1.4 pmp and 0.4 pmp.

Conclusion: In the observed period, the lowest rates of kidney transplantation from living and deceased donors, as well as liver and heart from deceased donors, were recorded in Serbia, in relation to all other European countries. The field of organ transplantation in Serbia is legally regulated by the Law on Human Organ Transplantation. Conditions for achieving quality standards and safety of human organs for transplantation have been determined by this law, as well as working conditions and ways of organizing the health system to ensure optimal organ transplantation and provision, high level of protection of human health, as well as respect priority interests for the preservation of life and health and protection of basic human rights and dignity of organ donors and recipients. Special emphasis should be placed on educating the population and health care workers about the importance of organ donation.

Keywords: transplantation, donation, kidney, heart, liver

Introduction

Human organ transplantation is a medical procedure, in which an organ or parts of organs are removed from the body of a living or deceased person and placed in the body of a recipient for the treatment, and it includes all the procedures for the preparation, preservation, observation of serious side effects and adverse effects, as well as distribution of organs, that is, parts of organs. Donation of organs is a procedure of removing an organ from a living or deceased person and placing it in another person, which is used for the medical treatment, without financial compensation (1). Cadaveric donation of human organs means that organs are taken from the recently dead donor. Living donation of human organs comprises donation of one paired organ (kidney) or one part of an organ (liver or lung lobe) from the living donor. Living donors are usually the members of recipient's family (2).

Today, transplantation presents the most efficient form of therapy for end-stage renal insufficiency, as well as the only available form of therapy for terminal heart, liver and lung disease (3). More than million people around the world experienced benefits after the well-performed organ

acije organa. Zahvaljujući modernim tehnikama očuvanja organa i unapređenju imunosupresije, mnogi pacijenti imaju dug i veoma kvalitetan život (4,5).

Procenjuje se da je 2017. godine obavljeno 139.024 transplantacija solidnih organa (90.306 transplantacija bubrega, 34.348 jetre, 7.881 srca, 6.084 pluća, 2.243 pankreasa i 163 tankog creva), što je samo 10% globalnih potreba (6). Najveći broj obavljenih transplantacija solidnih organa odnosio se na bubreg (65%) i jetru (23%). Dugo čekanje na transplantaciju doprinosi pogoršanju zdravstvenog stanja pacijenta ili smrtnom ishodu. Procene su da je dnevno u Evropi, tokom 2016. godine, umiralo 19 pacijenata koji su bili na listama čekanja za transplantaciju ljudskih organa, jer za njih nije bilo dostupnih organa (7).

Postignuti rezultati u evropskim zemljama iz oblasti doniranja i transplantacije ljudskih organa su različiti i pored činjenice da u svakoj od zemalja postoji jasno definisan zakonodavni okvir. Broj donacija organa od kadaveričnih donora na milion stanovnika (engl. *per million population* - pmp), nejednako je raspoređen unutar Evropske unije (EU). Tokom 2015. godine broj donora i stope doniranja su se kretale od 0 do 34,4 donora na milion stanovnika na nacionalnom nivou (8). Epidemija dijabetesa i arterijske hipertenzije, kao i opšti trend starenja stanovništva, rezultirali su povećanim potrebama za transplantacijom organa. Nesrazmera između ponude i potražnje ljudskih organa ukazuje na potrebu razmatranja različitih nacionalnih strategija za povećanje dostupnosti ljudskih organa za transplantaciju (8).

Svetska zdravstvena organizacija (SZO) pozvala je na usvajanje novih opštih pravila kojima bi vlade država preuzele nacionalni nivo odgovornosti u ispunjavanju potreba stanovništva za ljudskim organima za transplantaciju, pristupom resursima u okviru sopstvene populacije. Ovaj koncept je nazvan „nacionalna samodovoljnost". Vlade, odnosno nacionalni autoriteti treba sistemski da zadovolje svoje nacionalne potrebe u skladu sa nacionalnim pravnim okvirom. S tim u vezi, potrebno je implementirati medicinske strategije koje bi sprečile terminalne faze obolevanja i otkazivanja organa. Za postizanje nacionalne dovoljnosti u doniranju i transplantaciji organa, neophodan je sveobuhvatan nacionalni Program koji sadrži zakonodavni okvir sa politikom nadzora, program kadaverične donacije integrisan u zdravstveni sistem, etičku praksu žive donacije i transplantacije u skladu sa svetskim standardima, kao i program preventivne medicine za sprečavanje terminalnih stadijuma obolevanja organa (9).

Oblast transplantacije ljudskih organa u Republici Srbiji pravno je regulisana Zakonom o presađivanju ljudskih organa (10). Ovim Zakonom, oblast transplantacije ljudskih organa sistemski je potpuno uređena. Osim toga, utvrđeni su i obezbeđeni uslovi za postizanje standarda kvaliteta i bezbednosti ljudskih organa za transplantaciju, kao i uslovi rada i načina organizacije zdravstvenog sistema, u cilju obezbeđivanja optimalne dovoljnosti organa za transplantaciju i obezbeđivanja visokog nivoa zaštite ljudskog zdravlja, kao i uvažavanja prioritetnih interesa za očuvanje života i zdravlja i zaštite osnovnih ljudskih prava i dostojanstva davaoca i primaoca organa.

Pored toga, Zakon je u potpunosti usaglašen sa direktivama Evropske unije, i to: Direktivom 2010/53/EU Evropskog Parlamenta i Saveta od 7. jula 2010. godine o standardima kvaliteta i bezbednosti ljudskih organa koji su namenjeni transplantaciji, Direktivom 2012/25/EU od 9. oktobra 2012. godine kojom se utvrđuju procedure informisanja za razmenu ljudskih organa namenjenih za transplantaciju između država članica, kao i Zakonom o potvrđivanju konvencije o zaštiti ljudskih prava i dostojanstva ljudskog bića u pogledu primene biologije i medicine: Konvencija o ljudskim pravima i biomedicini (11).

Međunarodnim sporazumima i nacionalnim zakonima postavljen je pravni okvir za transplantaciju ljudskih organa koja se obavlja u svakoj od zemalja. Bitno je ustanoviti protokole za dijagnostikovanje smrti, razmenu informacija, davanje saglasnosti za uzimanje organa za transplantaciju, kao i za alokacione modele. Istanbulska Deklaracija je pozvala vlade da obezbede zaštitu i bezbednost živim davaocima ljudskih organa, dok se bore protiv transplantacionog turizma, trgovine ljudskim organima i transplantacione komercijalizacije. Vlade treba da odvraćaju od putovanja u strane destinacije u cilju odlaska na transplantaciju bubrega od živih davalaca koji su nepoznati primaocima (9,12).

Cilj ove deskriptivne studije je da se analizira učestalost doniranja i transplatacije bubrega, jetre i srca u Republici Srbiji za period 2010-2016. godine.

transplantation. Thanks to modern techniques of organ preservation and the improvement of immunosuppression, a lot of patients have a long and good quality life (4,5).

It is estimated that in 2017, 139.024 solid organ transplants were performed (90.306 kidney transplantations, 34.348 liver, 7.881 heart, 6.084 lungs, 2.234 pancreas and 163 small intestine transplantations), which is only 10% of global needs (6). The largest numbers of solid organ transplantations were kidney (65%) and liver transplantations (23%). Long waiting lists contribute to a further worsening of patient's health condition or deathly outcome. It is estimated that in Europe in 2016, 19 patients, who were on these waiting lists for the transplantation, died every day because there were no available organs for them (7).

Achieved results in the field of human organ donation and transplantation were different in European countries, although in each of these countries legislation is clearly defined. The number of donations from cadaveric donors per million inhabitants was unequally distributed within the European Union. In 2015, the number of donors and donation rates ranged from 0 to 34.4 donors per million population (pmp) at the national level (8). An epidemic of diabetes and arterial hypertension, as well as the general trend of population ageing, resulted in the increased need for organ transplantation. A disproportion in human organ supply and demand points to the fact that different national strategies for the increase in availability of human organs for transplantation should be considered (8).

The World Health Organization (WHO) called for the adoption of new guiding principles on the accountability of governments to fulfill their inhabitants' needs for organs for transplantation, by making resources accessible to their population. This concept was called the "national self-sufficiency". Governments, that is, national authorities should satisfy their national needs systematically, in accordance with the national legislation. Thus, medical strategies that would prevent terminal stages of disease and organ failure should be implemented. In order to achieve the national self-sufficiency regarding organ donation and transplantation, it is necessary to develop the comprehensive national program which would contain the legal framework with the policy of supervision, cadaveric donation program that would be integrated in the health system, ethical practice of living donation and transplantation in accordance with the world standards, as well as the preventive medicine program for the prevention of terminal stages of disease (9).

In the Republic of Serbia, the field of organ transplantation was legally regulated by the Law on human organ transplantation (10). With this law, the field of organ transplantation was systematically regulated. In addition to this, the conditions for achieving the standards of quality and safety of human organs intended for transplantation were determined and provided, as well as the conditions necessary for the operation and organization of the health care system aimed at providing optimal sufficiency in organs intended for transplantation and securing the high level of health care, and considering priorities for the preservation of life and health and protection of basic human rights and the dignity of donors and recipients.

In addition to this, the Law was completely in accordance with the European Union directives: Directive 2010/53/EU of the European Parliament and Council of 7 July 2010 on standards of the quality and safety of human organs intended for transplantation, Directive 2012/25/EU of 9 October 2012, which established the information procedures for the exchange of human organs intended for transplantation between member states, and the Law on confirming the Convention on human rights and dignity with regard to the application of Biology and Medicine (Convention on human rights and biomedicine) (11).

International treaties and national laws set the legal framework for organ transplantation, which is performed in each of these countries. It is important to establish protocols for the determination of death, exchange of information, consent to organ donation, as well as for allocation models. The Istanbul Declaration called governments to provide protection and safety for living donors, while they combated transplant tourism, organ trafficking and commercialism. Governments should dissuade people from traveling to foreign countries to undergo kidney transplantation from living donors who are not known to the recipients (9,12).

The aim of this descriptive study is to analyze the frequency of kidney, liver and heart donation and transplantation in the Republic of Serbia for the period 2010-2016.

Metode

U okviru ove deskriptivne studije, analiziran je broj donora i solidnih transplantiranih ljudskih organa u Republici Srbiji za period 2010-2016. godine.

Podaci o broju donora i transplantiranih ljudskih organa u Srbiji, za period 2010-2016. godine, dobijeni su iz godišnjih izveštaja Ministarstva zdravlja Republike Srbije - Uprave za biomedicinu. Podaci o broju stanovnika Srbije preuzeti su iz popisa stanovništva za 2011. godinu.

U analizi dobijenih podataka korišćene su proporcije i stope. Godišnja stopa transplantacija izračunata je tako što je za brojilac uzet broj transplantacija za posmatranu godinu, a za imenilac broj stanovnika Republike Srbije sredinom posmatrane godine. Sve prikazane stope su nestandardizovane i izražene na milion stanovnika.

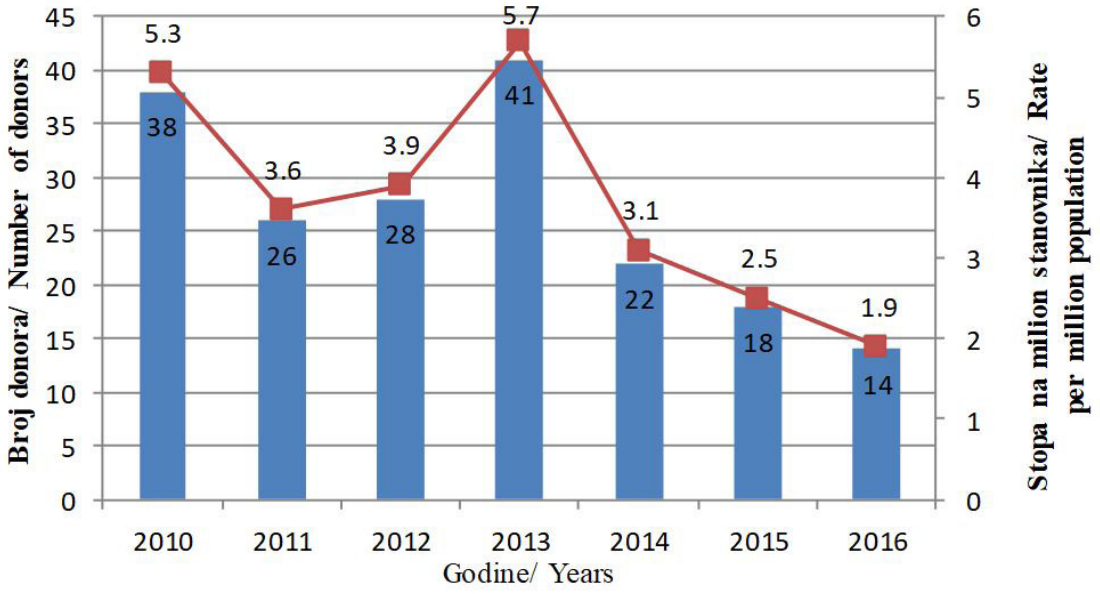
Rezultati

U periodu od 2010. do 2016. godine, u Republici Srbiji, najveća stopa doniranja zabeležena je 2013. godine (5,3 na milion stanovnika) i 2010. godine (5,7 na milion stanovnika), a najmanja 2016. godine (1,9 na milion stanovnika) (grafikon 1). U posmatranom periodu prosečan godišnji broj donora je bio 27, a prosečna stopa doniranja 3,7 na milion stanovnika.

Tokom poslednjih sedam godina, među svim izvedenim transplantacijama sa umrlih davalaca u Republici Srbiji, najveći procenat su činile transplantacije bubrega (78,3%), a zatim jetre (16,9%) i srca (4,8%) (grafikon 2).

U transplantacionim centrima u Republici Srbiji, tokom perioda 2010-2016. godine, obavljeno je 537 transplantacija bubrega, i to 328 transplantacija bubrega sa umrlih i 209 sa živih davalaca (tabela 1). Stopa transplantacija bubrega sa umrlih davalaca na milion stanovnika kretala se od 3,1 u 2016. godini do 10,3 u 2013. godini, a sa živih davalaca od 3,2 u 2016. godini do 4,9 u 2012. godini. U svim posmatranim godinama stopa transplantacija bubrega je bila veća sa umrlih nego sa živih davalaca. Prosečna stopa transplantacija bubrega za sedmogodišnji period iznosila je 10,6 na milion stanovnika, odnosno 4,1 na milion stanovnika kada su u pitanju živi davaoci i 6,5 na milion stanovnika kada su u pitanju umrli davaoci. Od 2014-2016. godine dolazi do izrazitog opadanja ukupne stope transplantacija bubrega (sa 14,0 na milion u 2010. godini na 6,3 na milion u 2016. godini).

U istom periodu obavljena je 71 transplantacija jetre i 20 transplantacija srca sa umrlih davalaca (tabela 2). Prosečna stopa transplantacija jetre sa umrlih davalaca iznosila je 1,4 na milion stanovnika, a za srce 0,4 na milion stanovnika. Stopa transplantacija jetre (na milion stanovnika) je opadala od 2010. do 2016. godine sa 2,6 na 1,1, a rasla za srce od 0,6 na milion stanovnika u 2013. godini, na 0,8 na milion stanovnika u 2016. godini. U posmatranom periodu, broj realizovanih transplantacija svih organa sa umrlih davalaca, za period od 2010.



Grafikon 1. Broj donora i stope doniranja (na milion stanovnika) za period 2010-2016. godine u Republici Srbiji

Methods

The number of donors and solid transplant organs in the Republic of Serbia for the period 2010-2016 was analyzed in this descriptive study.

Data on the number of donors and transplant organs in Serbia for the period 2010-2016 were obtained from the annual reports of the Ministry of Health of the Republic of Serbia – Directorate of Biomedicine. Data on the population of Serbia were taken from the 2011 census.

Rates and proportions were used for the analysis of the obtained data. The annual transplantation rate was calculated by taking the number of transplantations for the observed year as the numerator, and the number of inhabitants of the Republic of Serbia in the middle of the observed year as the denominator. All rates shown are non-standardized and expressed per million population.

Results

In the period 2010-2016, in the Republic of Serbia, the highest donation rates were registered in 2013 (5.3 pmp) and in 2010 (5.7 pmp), while the lowest rate was in 2016 (1.9 pmp) (Figure 1). The average annual number of donors was 27, while the average rate of donations was 3.7 pmp in the observed period.

During the last seven years, of all performed transplantations from deceased donors in the Republic of Serbia, the highest percentages had kidney transplants (78.3%), followed by liver (16.9%) and heart transplants (4.8%) (Figure 2).

In transplant centers in Serbia, during the period 2010-2016, 537 kidney transplants were performed, that is, 328 kidney transplants from deceased and 209 from living donors (Table 1). The rate of kidney transplants from deceased donors ranged from 3.1 pmp in 2016 to 10.3 pmp in 2013, while from living donors this rate was 3.2 pmp in 2016 and 4.9 pmp in 2012. In all the observed years, the rate of kidney transplants was higher for deceased than for living donors. The average rate of kidney transplantations for the seven-year period amounted to 10.6 pmp, that is, 4.1 pmp for living donors and 6.5 pmp for deceased donors. There came to the significant decrease in the total rate of kidney transplants from 2010 to 2016 (from 14.0 pmp in 2010 to 6.3 pmp in 2016).

In the same period, 71 liver transplantations and 20 heart transplantations were performed from deceased donors (Table 2). The average rate of liver transplants from deceased donors was 1.4 pmp, whereas the rate of heart transplants amounted to 0.4 pmp. The liver transplantation rate declined from 2.6 pmp in 2010 to 1.1 pmp in 2016, while it increased in case of heart transplantations from 0.6 pmp in 2013 to 0.8 pmp in 2016. In the observed period from 2010 to 2016, the number of all performed transplantations from deceased donors was 419. The rate of all transplantations decreased from 11.9 pmp in 2010 to 5.0 pmp in 2016.

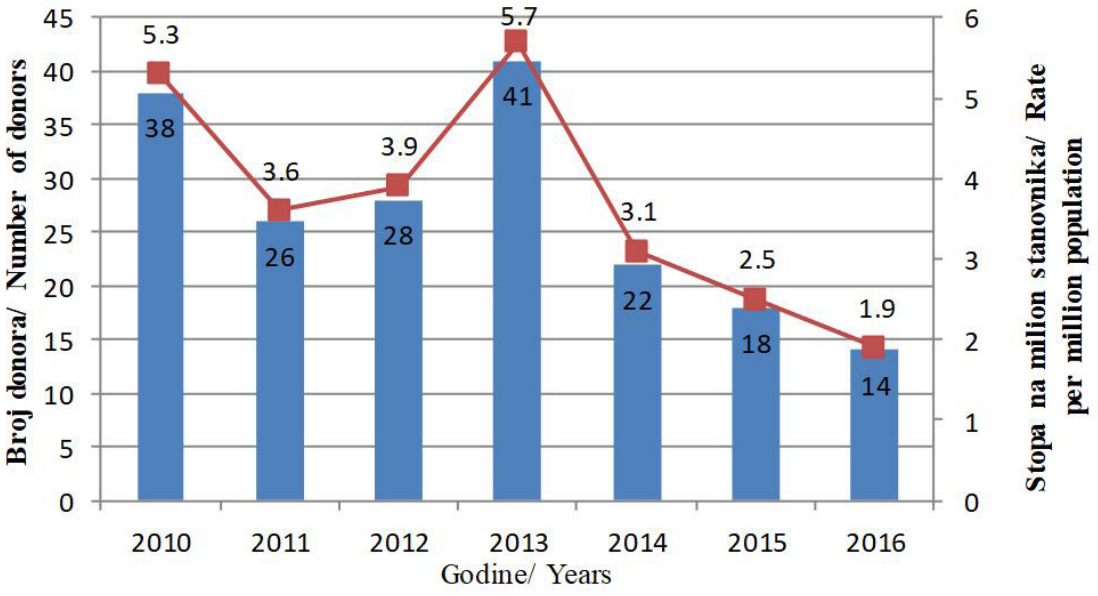
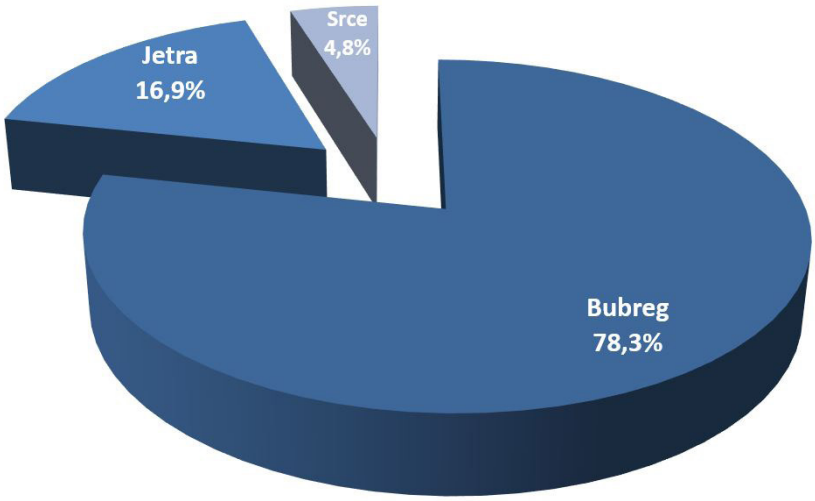


Figure 1. Number of donors and donation rates (pmp) for the period 2010-2016 in the Republic of Serbia



Grafikon 2. Procentualno učešće transplantacija bubrega, srca i jetre među svim transplantacijama sa umrlih davalaca za period 2010-2016. godine u Republici Srbiji

do 2016. godine, je bio 419. Stopa transplantacija svih organa je opala sa 11,9 na milion stanovnika u 2010. godini na 5,0 na milion stanovnika u 2016. godini.

Diskusija

Prosečna stopa doniranja u Republici Srbiji, za period 2010-2016. godine, je bila 3,7 na milion stanovnika. U poređenju sa drugim zemljama Evrope, stopa doniranja u Republici Srbiji je ekstremno niska. Manjak donora je glavni problem kako za Srbiju, tako i za sve evropske države u vezi sa transplantacijom ljudskih organa. U Evropi postoje značajne razlike u stopi doniranja organa, koje su u 2017. godini varirale od 46,9 donora na milion stanovnika u Španiji, 33,0 u Hrvatskoj, 23,1 u Velikoj Britaniji, do 5,5 u Grčkoj i 3,3 u Rumuniji (13,14). Ove razlike se ne mogu objasniti samo razlikama u stopama mortaliteta. Procenjuje se da se liste čekanja za transplantaciju ljudskih organa proširu-

Tabela 1. Broj i stopa transplantacija bubrega (na milion stanovnika) sa živih i preminulih davalaca, kao i ukupno, za period 2010-2016. godine u Republici Srbiji

Godina	Broj živih davalaca (Stopa na milion)	Broj umrlih davalaca (Stopa na million)	Ukupan broj davalaca (Stopa na million)
2010.	33 (4,7)	67 (9,4)	100 (14,0)
2011.	34 (4,8)	49 (6,9)	83 (11,7)
2012.	35 (4,9)	47 (6,6)	82 (11,5)
2013.	30 (4,2)	74 (10,4)	104 (14,6)
2014.	26 (3,7)	37 (5,2)	63 (8,9)
2015.	28 (3,9)	32 (4,5)	60 (8,4)
2016.	23 (3,2)	22 (3,1)	45 (6,3)
2010- 2016.	209 (4,1)	328 (6,5)	537 (10,6)

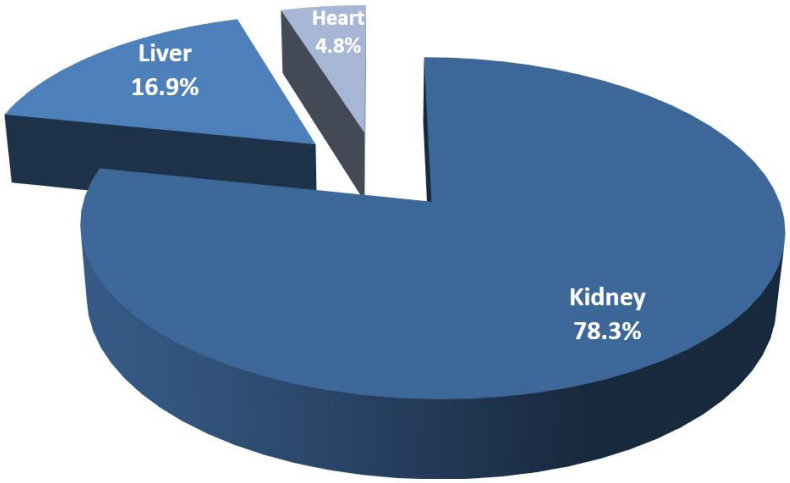


Figure 2. Percentage share of kidney, heart and liver transplants among all transplants from deceased donors for the period 2010-2016 in the Republic of Serbia

Discussion

The average rate of donation in the Republic of Serbia for the period 2010-2016 was 3.7 pmp. In comparison to other European countries, the rate of donation is extremely low. The lack of donors is the main problem in relation to human organ transplantation not only in Serbia, but in all European countries, as well. There is significant difference in the rate of organ donation in Europe, which in 2017 ranged from 46.9 donors pmp in Spain, 33.0 in Croatia, 23.1 in Great Britain to 5.5 in Greece and 3.3 in Romania (13,14). This difference cannot be explained only by difference in mortality rates. It is estimated that waiting lists for human organ transplants are expanded every 10 minutes with one new person who needs transplantation (15).

The number of human organs available for transplantation does not meet the real needs, not even closely, and therefore, the lack of organs presents a global problem, dilemma and chal-

Table 1. Number and rate of kidney transplants (pmp) from living and deceased donors, as well as total, for the period 2010-2016 in the Republic of Serbia

Year	No of living donors (rate pmp)	No of deceased donors (rate pmp)	No of total donors (rate pmp)
2010	33 (4.7)	67 (9.4)	100 (14.0)
2011	34 (4.8)	49 (6.9)	83 (11.7)
2012	35 (4.9)	47 (6.6)	82 (11.5)
2013	30 (4.2)	74 (10.4)	104 (14.6)
2014	26 (3.7)	37 (5.2)	63 (8.9)
2015	28 (3.9)	32 (4.5)	60 (8.4)
2016	23 (3.2)	22 (3.1)	45 (6.3)
2010- 2016	209 (4.1)	328 (6.5)	537 (10.6)

Tabela 2. Broj i stope svih transplantacija (na milion stanovnika), kao i jetre i srca, sa preminulih davalaca za period 2010-2016. godine u Republici Srbiji

Godine Karakteristike	2010.	2011.	2012.	2013.	2014.	2015.	2016.	2010-2016.
Broj (%) transplantacija jetre sa preminulih davalaca	19 (26,8)	9 (12,7)	7 (9,9)	17 (23,9)	4 (5,6)	7 (9,9)	8 (11,3)	71 (100,0)
Stopa transplantacija jetre sa preminulih davalaca na million stanovnika	2,6	1,3	1,0	2,4	0,6	1,0	1,1	1,4
Broj (%) transplantacija srca sa preminulih davalaca	-	-	-	4 (20,0)	5 (25,0)	5 (25,0)	6 (30,0)	20 (100,0)
Stopa transplantacija srca sa preminulih davalaca na milion stanovnika	-	-	-	0,6	0,7	0,7	0,8	0,4
Ukupan broj (%) svih transplantacija sa preminulih davalaca	86 (20,5)	58 (13,8)	54 (12,9)	95 (22,7)	46 (11,0)	44 (10,5)	36 (8,6)	419 (100,0)
Stopa svih transplantacija sa preminulih davalaca na milion stanovnika	11,9	8,1	7,5	13,2	6,4	6,1	5,0	8,3

ju na svakih 10 minuta sa jednom novom osobom kojoj je neophodna transplantacija (15).

Broj ljudskih organa dostupnih za presađivanje ni približno ne prati stvarne potrebe, te nedostatak organa predstavlja globalni problem, dilemu i izazov transplantacionih sistema. Jedan od razloga leži delimično u činjenici da je prikupljanje organa sa umrlih lica uglavnom bazirano na doniranju nakon moždane smrti, pri čemu se mora naglasiti da tek oko 1% umrlih, te ne više od 3% umrlih u bolnici, podleže toj situaciji (16,17). Globalni manjak raspoloživih organa za transplantaciju otvara mnoga bioetička pitanja, uključujući i dileme kako da se alociraju ograničeni resursi neograničenom broju potreba i na taj način ponudi fer i ravnopravan pristup transplantaciji organa svim pacijentima (18).

U Republici Srbiji dolazi do izrazitog opadanja ukupne stope transplantacija bubrega sa 14,0 na milion u 2010. godini na 6,3 na milion u 2016. godini. Prosečna stopa transplantacija bubrega (na milion stanovnika), za sedmogodišnji period, iznosila je 10,6, odnosno 4,1 na milion stanovnika kada su u pitanju živi davaoci i 6,5 na milion stanovnika kada su u pitanju umrli davaoci.

Prva uspešna transplantacija organa je transplantacija bubrega između identičnih blizanaca koja je izvršena u Bostonu 23. decembra 1954. godine (19). Ona je predstavljala jedan novi početak za sve bolesnike sa ireverzibilnim oštećenjem bubrega. Istraživanje sprovedeno na 46.164 pacijenata, koji su bili na listama čekanja za transplantaciju ljudskih organa u SAD-a, između 1991-1997. godine, pokazala je da je smrtnost niža za 68% kod pacijenata koji su bili podvrgnuti transplantaciji nego kod osoba koje su ostale na listi čekanja za transplantaciju bubrega nakon više od tri godine praćenja (20). Takođe, procenjeno je da pacijenti uzrasta 20-39 godina kod kojih je obavljena transplantacija žive 17 godina duže nego osobe koje ostanu na listama čekanja za transplantaciju ljudskih organa, što je posebno bilo izraženo kod osoba sa dijabetesom (20).

Prema podacima Eurotransplanta, u 2019. godini Španija je imala najveću stopu transplantacija bubrega (73,8 na milion stanovnika) u Evropi i ona je bila veća nego 2018. godine (71,4 na million stanovnika) (21). Sledeće dve zemlje sa najvećim brojem obavljenih transplantacija bubrega su Francuska (55,6 transplantacija bubrega na milion

Table 2. Number and rate of all transplantations (pmp), as well for liver and heart, from deceased donors for the period 2010-2016 in the Republic of Serbia

Years Characteristics	2010	2011	2012	2013	2014	2015	2016	2010-2016
No (%) of liver transplants from deceased donors	19 (26.8)	9 (12.7)	7 (9.9)	17 (23.9)	4 (5.6)	7 (9.9)	8 (11.3)	71 (100.0)
Liver transplantation rate from deceased donors pmp	2.6	1.3	1.0	2.4	0.6	1.0	1.1	1.4
No (%) of heart transplants from deceased donors	-	-	-	4 (20,0)	5 (25,0)	5 (25,0)	6 (30,0)	20 (100,0)
Heart transplantation rate from deceased donors pmp	-	-	-	0.6	0.7	0.7	0.8	0.4
Total no (%) of transplants from deceased donors	86 (20.5)	58 (13.8)	54 (12.9)	95 (22.7)	46 (11.0)	44 (10.5)	36 (8.6)	419 (100.0)
Total rate of transplants from deceased donors pmp	11.9	8.1	7.5	13.2	6.4	6,1	5.0	8.3

lenge for transplant systems. One of the reasons is partly in the fact that taking organs from deceased persons is mainly based on donations after brain death, while it should be emphasized that only 1% of deceased, not more than 3% of those who died in hospitals, are subject to this situation (16,17). A global lack of available organs intended for transplantation opens many bioethical questions and dilemmas how to allocate limited resources to the unlimited number of needs, and thus offer the fair and equal access to organ transplantations to all patients (18).

In the Republic of Serbia, there came to the significant decrease in the total rate of kidney transplants from 14.0 pmp in 2010 to 6.3 pmp in 2016. The average rate of kidney transplantation for the seven-year period amounted to 10.6 pmp, that is, 4.1 pmp for living donors, and 6.5 pmp for deceased donors.

The first successful kidney transplantation between identical twins was performed in Boston, on December 23rd, 1954 (19). It represented a new beginning for all patients with the irreversible kidney damage. The research, which was conducted on 46.164 patients who were on the list waiting for human organ transplantation in the USA between 1991 and 1997, showed that mortality was lower for 68% in patients who underwent transplantation than in persons who remained on the waiting list for kidney transplantation after three years of follow-up (20). Also, it was estimated that patients aged 20-39 who underwent transplantation, lived 17 years longer than people who stayed on the waiting lists for human organ transplantation, which was particularly pronounced in persons with diabetes (20).

According to the data of Eurotransplant, in 2019 Spain had the highest rate of kidney transplantations (73.8 pmp) in Europe and it was higher than in 2018 (71.4 pmp) (21). The next two countries with the largest number of performed kidney transplantations were France (55.6 pmp) and Finland (52.3 pmp), whereas the lowest rate of kidney transplantations was registered in Serbia. Eurotransplant is an international, non-profit organization that was founded by professor van Rod in Leiden, Netherlands in 1967. This international organization includes eight countries in Europe: Austria, Belgium, Croatia, Germany, Luxemburg, Netherlands, Slovenia, Hungary, with approximately 137 million inhabitants. All member states of this association share a common waiting list for organs intended for transplantation. Eurotransplant provides cooperation of all transplant

stanovnika) i Finska (52,3 na milion stanovnika), dok se najniža stopa transplantacija bubrega beleži u Srbiji. Eurotransplant je međunarodna neprofitna organizacija koju je osnovao prof. dr van Rood 1967. godine u Lajdenu, u Holandiji. Ova međunarodna organizacija obuhvata osam zemalja Evrope: Austriju, Belgiju, Hrvatsku, Nemačku, Luksemburg, Holandiju, Sloveniju i Mađarsku u kojima živi približno 137 miliona stanovnika. Sve zemlje članice ovog udruženja dele zajedničku listu čekanja organa za transplantaciju. Eurotransplant obezbeđuje saradnju svih transplantacionih centara, laboratorija za tipizaciju tkiva i donorskih bolnica, koje su uključene u transplantacioni proces. Prednost članstva i saradnje je jedan donorski identifikacioni sistem i jedinstvena međunarodna Lista čekanja, što zemljama članicama obezbeđuje bržu i veću dostupnost organa, čime bi se povećao broj uspešno obavljenih transplantacija ljudskih organa, smanjila dužina čekanja na transplantaciju i smanjila smrtnost na listama čekanja.

U zemljama u našem okruženju, takođe su mnogo veće stope transplantacija bubrega (na milion stanovnika), kao što su u Hrvatskoj (32,9), Mađarskoj (27,4), Poljskoj (25,9), Sloveniji (18,1) i Grčkoj (16), nego što su u našoj zemlji. Takođe, podaci govore da je u Evropi stopa transplantacija bubrega sa umrlih davalaca dvostruko veća od stope transplantacija bubrega sa živih davalaca (22 pmp naspram 9 pmp) (22), što je dobijeno i u našem istraživanju (6,5 na milion kada su u pitanju umrli davaoci i 4,1 na milion kada su u pitanju živi davaoci). Najveće stope transplantacija bubrega sa umrlih davalaca zabeležene su u nekim regionima Španije (>70 pmp), a najveća stopa transplantacija bubrega sa živih davalaca je u Severnoj Irskoj (38 pmp), Holandiji (33 pmp) i Turskoj (33 pmp).

U Republici Srbiji prosečna stopa transplantacija jetre sa umrlih davalaca iznosila je 1,4 na milion stanovnika, a za srce 0,4 na milion stanovnika. Ove stope su daleko niže od drugih zabeleženih u Evropi. U 2019. godini Hrvatska je imala najveću stopu transplantacija jetre koja je iznosila 30 na milion stanovnika (21). Zemlje sa najvećim stopama transplantacija jetre, iza Hrvatske, su bile Španija (26,4 transplantacija jetre na milion stanovnika) i Danska (11 na milion stanovnika). Najniža stopa transplantacija jetre u Evropi je bila u Grčkoj (tri na milion) i Bugarskoj (dva na milion).

U Evropi je u 2019. godini Slovenija imala najveću stopu transplantacija srca (10,5 na milion stanovnika), a zatim Hrvatska (9,3 na milion stanovnika) i Norveška (8 na milion stanovnika) (21). Srce za transplantaciju se uzima od zdravog davaoca (donora) kod kojeg je dijagnostikovana i potvrđena moždana smrt. Kako transplantacija srca zahteva uzimanje organa sa nedavno preminulog davaoca kod kojeg je utvrđena moždana smrt, neophodno je pre uzimanja organa izvršiti proveru identiteta davaoca i uslove pristanka, odnosno nepostojanje protivljenja za doniranje organa, kao i detaljne medicinske analize kojima se proverava da li je srce zdravo i očuvano, odnosno pogodno za transplantaciju. Ukoliko se umrlo lice za života nije izjasnilo da ne želi da donira svoje organe, obavezno se razgovara sa porodicom umrlog lica radi dobijanja saglasnosti za doniranje organa njihovog umrlog člana. U Irskoj je 2016. godine, 50% porodica odbilo da pristane na to da se organi umrlih članova njihove porodice koriste za potrebe transplantacije nakon smrti. Ovo je bila najviša stopa odbijanja u Evropi između 2015. i 2017. godine. Slovenija je imala stopu odbijanja porodice od oko 16% u 2017. godini. Nažalost, postoje mnogi slučajevi gde bolesnici ne uspevaju da prežive dovoljno dugo na listama čekanja za transplantaciju srca da bi dobili novo srce. U 2019. godini, najveći broj umrlih među bolesnicima koji su čekali transplantaciju srca je bio u Nemačkoj (107), a zatim u Poljskoj (93) i u Francuskoj (61).

Na osnovu niskih prosečnih stopa doniranja, transplantacija bubrega, jetre i srca u našoj zemlji, jasno je da su transplantacioni centri iz Republičkog programa za presađivanje ljudskih organa u manjoj ili većoj meri suočeni sa manjkom ljudskih organa. Jedan od razloga za niske stope doniranja može biti i izostanak dovoljno jasnih i preciznih procedura u Zakonu o presađivanju ljudskih organa, i pratećim pravilnicima koji se odnose na pristanak/protivljenje davanja organa sa umrle osobe u svrhe presađivanja, jer dovode do nepoverenja kod većine stanovnika. Pored toga, ne postoji funkcionalni Registar lica kod kojih je izvršena transplantacija (organa, tkiva, ćelija), koji bi imao i registrovane donore organa koji su dali svoj pristanak tokom života (kao evropski Registri). Niskim stopama doniranja doprinosi nesprovođenje kampanja, koje bi za cilj imale edukaciju, motivaciju i promociju transplantacije.

Nacionalni autoriteti pokušavaju da pronađu uspešne modele i strategije za povećanje broja realizovanih donora i stope doniranja, odnosno

centers, laboratories for tissue typing and donor hospitals that are involved in the transplantation process. The advantage of membership and co-operation is one donor identification system and unique international waiting list, which provides faster and greater availability of organs to member states, and which would increase the number of successfully performed human organ transplantations, reduce the time spent waiting for transplantation and reduce mortality on the waiting lists.

Rates of kidney transplantations were greater in neighboring countries, such as Croatia (32.9 pmp), Hungary (27.4 pmp), Poland (25.9 pmp), Slovenia (18.1 pmp) and Greece (16 pmp) than in our country. Also, data showed that in Europe the rate of kidney transplantations from deceased donors was twofold higher than the rate of kidney transplantations from living persons (22 pmp vs. 9 pmp) (22), which was obtained in our research, as well (6.5 pmp for deceased donors and 4.1 pmp for living donors). The highest kidney transplantation rates from deceased persons were registered in some regions in Spain (>70 pmp), while the highest rates of kidney transplantation from living donors were in North Ireland (38 pmp), Holland (33 pmp) and Turkey (33 pmp).

In the Republic of Serbia, the average rate of liver transplantation form deceased donors amounted to 1.4 pmp, while the rate of heart transplantation was 0.4 pmp. These rates were quite lower than other registered rates in Europe. In 2019, Croatia had the highest liver transplantation rate which amounted to 30 pmp (21). Countries with the highest liver transplantation rates, behind Croatia, were the following: Spain (26.4 pmp) and Denmark (11 pmp). The lowest liver transplantation rate in Europe was in Greece (3 pmp) and Bulgaria (2 pmp).

In Europe, in 2019, the highest rate of heart transplantation (10.5 pmp) was in Slovenia, and then in Croatia (9.3 pmp) and Norway (8 pmp) (21). Heart intended for transplantation is taken from a healthy donor, when brain death is diagnosed and confirmed. Since heart transplantation demands taking organs from the brain dead person, the identity of donor and conditions of consent should necessarily be checked before the procedure, that is, the absence of refusal of organ donation, and detailed medical analyses should be performed to check whether the heart is healthy and preserved, that is, suitable for transplantation. If a person did not state during their lifetime that they did not want to donate their organs, one should necessarily talk to the family of deceased in order to get consent to organ donation of their family member who passed away. In Ireland in 2016, 50% of families refused to give consent to use organs of deceased family members for transplantation. This was the highest rate of refusal in Europe between 2015 and 2017. The rate of family refusal or organ donation was around 16% in Slovenia in 2017. Unfortunately, there were numerous cases when patients were on the waiting lists for transplantation, but they did not live long enough to get a new heart. In 2019, the largest number of deceased who waited for heart transplantation was in Germany (107), and then in Poland (93) and France (61).

According to the low average rates of donation, kidney, liver and heart transplantations in our country, it is clear that transplant centers from the National Program for human organ transplantation are faced more or less with the lack of human organs. One of the reasons for the low donation rates there may also be a lack of sufficiently clear and precise procedure in the Law on Human Organ Transplantation, and accompanying regulations relating to consent/opposition to organ donation from the deceased persons for the purpose of transplantation because they lead to mistrust in most residents. Besides, no there is a functional Register of persons with whom it was performed transplantation (organs, tissues, cells), which would also have registered organ donors who gave its lifelong consent (as European Registers). Non-implementation contributes to low donation rates campaigns aimed at education, motivation, and promotion of transplantation.

National authorities are trying to find successful models and strategies for the increase in the number of realized donors and donation rates, that is, to provide the national self-sufficiency, and therefore, the organizational structure is the key structure in the systems of human organ donation and transplantation. Without the active program for the identification of human organ donors and programs for referral which should be established in all donor hospitals, the possibility of getting organs from deceased donors will be lost. Not recognizing potential donors is the main reason which explains the difference in average donation rates in different transplant centers and donor hospitals. Specific

obezbeđenje samodovoljnosti za sopstveno stanovništvo, imajući u vidu da je organizaciona struktura ključ u sistemima donacije i transplantacije ljudskih organa. Bez aktivnog programa identifikacije davalaca ljudskih organa (donora) i programa za upućivanje koji treba da bude uspostavljen u svakoj donor bolnici, mogućnost dobijanja, odnosno doniranja organa od umrlih davalaca će biti izgubljena. Neprepoznavanje potencijalnih davalaca organa je najvažniji razlog koji objašnjava razlike u prosečnim stopama doniranja u različitim transplantacionim centrima i donor bolnicama. U svakoj zdravstvenoj ustanovi, odnosno transplantacionom centru potrebno je uspostaviti posebne protokole i standardne operativne procedure sa određenim kliničkim parametrima kako bi se olakšala blagovremena identifikacija davalaca ljudskih organa.

Bolnički koordinatori za transplantaciju organa imaju ključnu ulogu u obezbeđivanju kvaliteta detekcije, odnosno otkrivanja donora i algoritama upućivanja donora. Potrebno je uložiti napore da se obezbedi adekvatna edukacija i obuka svih zdravstvenih radnika koji leče pacijente sa razornim povredama mozga u jedinicama intenzivnog lečenja, odeljenjima za hitno zbrinjavanje i odeljenjima za neurologiju, odnosno neurohirurgiju. Procedura doniranja ljudskih organa mora biti sastavni deo kontinuiranog nastavka lečenja i u osnovi prakse rutinskog upućivanja od strane lekara iz jedinica intenzivnog lečenja čija je osnovna dužnost očuvanje života prilikom zbrinjavanja pacijenata sa razornom povredom mozga.

Zaključak

U Republici Srbiji su veoma niske stope doniranja, kao i stope transplantacija bubrega, jetre i srca, u odnosu na zemlje u okruženju, a pogotovo u odnosu na zemlje zapadne Evrope, što zahteva snažne udružene aktivnosti svih pripadnika društva, prvenstveno države, Ministarstva zdravlja - Uprave za biomedicinu, drugih institucija, zdravstvenog sistema, nevladinog sektora, religijskih zajednica i svakog pojedinca ponaosob, u cilju unapređenja i što je moguće efikasnijeg sistema transplantacije ljudskih organa u Republici Srbiji, što je preduslov za saradnju i zaključivanje međunarodnih sporazuma.

Dobrom organizacijom zdravstvene službe i uspostavljenim efikasnim sistemom za identifikaciju i realizaciju potencijalnih donora ljudskih organa, kao i unapređenjem kvaliteta i bezbednosti transplantacije ljudskih organa, može se postići povećanje stope doniranja, odnosno smanjenje razlike između ponude i potražnje za organima za transplantaciju u Republici Srbiji.

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protocols and standards of operational procedures with specific clinical parameters should be established in all health care institutions, that is, transplant centers in order to facilitate timely identification of donors of human organs.

Hospital coordinators of organ transplantation have a key role in providing the quality of detection of donors and algorithms of referral of possible organ donors. Efforts should be made to provide adequate education and training of health care workers who treat patients with devastating brain injuries in intensive care units, emergency departments, neurology and neurosurgery departments. The procedure of human organ donation should be an integral part of continuous treatment and it should be part of doctor's practice and routine referral from intensive care units, while preservation of life is the basic responsibility of doctors who treat patients with devastating brain injuries.

Conclusion

The rate of donation is very low in the Republic of Serbia, as well as rates of kidney, liver and heart transplantations in comparison to countries of western Europe, which demands strong associated activities of all members of one society, first of all, of state, Directorate for Biomedicine, other institutions, health system, non-governmental sector, religious communities and all individuals aimed at promoting the most efficient possible system of human organ transplantation in the Republic of Serbia, which is a precondition for cooperation and conclusion of international contracts.

The increase in donation rates and the decrease of the difference between supply and demand of human organ transplantation in Republic of Serbia can be achieved by good organization of health care service and establishment of efficient systems for the identification and realization of possible human organ donors, as well as by the promotion of quality and safety of organ transplantation.

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