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Current opinions in horseshoe kidney transplantation

Received: 22 February 2001
Accepted: 3 October 2001
Published online: 21 March 2002
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Abstract Currently, horseshoe kidneys are also being considered for transplantation due to the shortage of organs. They can be transplanted en bloc or after division of the renal isthmus. However, because of their low incidence, horseshoe kidneys are rarely transplanted. The considerable variation in vascular anatomy of the horseshoe kidney add to both the frequency of primary non-function and the technical difficulty of the transplantation. In the study reported here, the surgical members of the European Society for Organ Transplantation were asked for their opinions regarding the techniques

and results of horseshoe kidney transplantation. Most surgeons advised explanting the horseshoe kidney en bloc. The decision to transplant en bloc or after division of the renal isthmus depended on the morphology of the renal isthmus, the number and position of renal vessels and/or the anatomy of the urinary collecting system. Most surgeons thought that the results of horseshoe kidney transplantation were equal to those of normal kidneys.

Keywords ESOT · Horseshoe kidney · Opinion · Transplantation

Introduction

Due to the increasing shortage of cadaver organ donors, kidneys with an atypical anatomy are currently also being considered for transplantation. The horseshoe kidney is the most common anatomical variation of the kidney, with an incidence of one in 600–800 [3]. Horseshoe kidneys display a great variation in origin, number and size of renal arteries and veins [3]. This makes it technically more challenging to use them for transplantation. Horseshoe kidneys can be transplanted en bloc or they can be divided and transplanted into two recipients. Due to their low incidence there are no protocols for the transplantation of horseshoe kidneys. A study of the literature reveals some publications with recommendations on this subject [4, 5]. However, these recommendations were often based on a case report. The aim of this study is

to investigate current opinions on horseshoe kidney transplantation among transplant surgeons throughout Europe.

Methods

The names and addresses of all the members of the European Society for Organ Transplantation (ESOT) were obtained through its secretary. The addresses of the members were searched for the departments of General Surgery, Transplant Surgery or Urology. These members of the ESOT were sent a questionnaire. Eleven questions were asked regarding experience in the explantation and transplantation of horseshoe kidneys, whether the surgeons would transplant a horseshoe kidney when offered, what operative and diagnostic procedures concerning the explantation and transplantation of horseshoe kidneys they would follow, and their opinion on the results of horseshoe kidney transplantation compared to kidneys with a normal anatomy (Fig. 1).

Results

A total of 282 questionnaires were sent. The response rate was 46.1%. Of the 130 forms that were returned, 18 were incomplete and discarded, leaving 112 forms for analysis. Of these 112 surgeons, 73 (65.2%) had procured a horseshoe kidney. These horseshoe kidneys were transplanted in 32 (43.8%) cases. Sixteen (21.9%) horseshoe kidneys had been discarded and 25 (34.2%) surgeons could not remember whether the horseshoe kidney was transplanted or not. Of the 112 participating

surgeons, 30 (26.8%) had transplanted a horseshoe kidney, compared to 82 (73.2%) who had not. If they were offered a horseshoe kidney, 102 (91.1%) surgeons would transplant it. Ten (8.9%) surgeons would discard the horseshoe kidney. The reasons that were given for discarding a horseshoe kidney had to do with the risk involved in transplanting a graft with a high vascular complexity. Twenty three (22.5%) of the surgeons who would transplant the horseshoe kidney, would transplant it en bloc. Transplantation after division of the renal isthmus would be performed by 19 (18.6%)

Fig. 1. Horseshoe kidney transplantation: attitude study

Horseshoe Kidney Transplantation: Attitude Study
O.B. Stroosma

Name: _____
City: _____
Country: _____

1. Have you ever procured a horseshoe kidney?
 Yes No
2. If yes, was that horseshoe kidney transplanted?
 Yes No
3. Have you ever transplanted a horseshoe kidney?
 Yes No
4. When you were offered a horseshoe kidney, would you transplant it?
 Yes No
5. If not, why?

6. If yes, would you transplant it en bloc or split?
 En bloc Split Depending on ...
7. On what would your decision depend?
 Number of renal arteries Number and position of renal arteries
 Parenchymatous or fibrous isthmus Anatomy of urinary collecting system
 Other: _____
8. How would you explant a horseshoe kidney?
 En bloc, inspection on backtable Split in situ
 Other: _____
9. How would you diagnose the isthmus and the urinary collecting system of the horseshoe kidney after procurement?
 No diagnostic test, just inspection Injection of contrast into the ureters
 Other: _____
10. What are the results of horseshoe kidney transplantation in comparison to "normal" kidneys in your opinion? Please guess.
 Better than "normal" kidneys Worse than "normal" kidneys
 Equal to "normal" kidneys
11. Do you have any other comment?

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surgeons. A total of 60 (58.8%) surgeons would let their decision to transplant en bloc or after division depend on the following factors: the number of renal arteries ($n=8$; 7.8%), the number and position of the renal arteries ($n=57$; 55.9%), a parenchymatous or fibrous isthmus ($n=38$; 37.3%) and the anatomy of the urinary collecting system ($n=53$; 52.0%). Other factors mentioned were: the donor and recipient age ($n=4$; 3.9%), the anatomy of the veins ($n=2$; 2.0%), the parenchymal mass of the renal isthmus ($n=2$; 2.0%) and the compatibility and urgency ($n=1$; 1.0%). The horseshoe kidney would be explanted en bloc and, when applicable, divided on the back table by 93 (91.2%) surgeons. Seven (6.9%) surgeons would split the horseshoe kidney in situ before explanting it. Two (2.0%) surgeons proposed letting the decision depend on the donor condition. If the donor was hemodynamically stable, the division of the renal isthmus should be performed in situ, to limit ischemic time. The majority of the surgeons ($n=61$; 59.8%) did not need a diagnostic test to be informed of the anatomy of the isthmus and the urinary collecting system after procurement. The other option given on the questionnaire, injection of contrast into the ureters, followed by an X-ray, was chosen by 35 (34.3%) surgeons. Four (3.9%) surgeons proposed to use methylene blue to determine for themselves the anatomy of the urinary collecting system, and two surgeons (2.0%) proposed to cannulate the urinary collecting system with a probe to get an idea of the anatomy. Six of the total of 112 surgeons (5.4%) thought that the post-transplant function of horseshoe kidneys was better than that of kidneys with a normal anatomy. They all noted on the form that this would only be true for en-bloc-transplanted horseshoe kidneys. Most surgeons ($n=80$; 71.4%) thought that the results of horseshoe kidney transplantation would be equal to that of kidneys with a normal anatomy, and 26 (23.2%) surgeons thought the results would be worse. No differences could be found in the answers of the surgeons who had actually transplanted a horseshoe kidney and those who had not.

Discussion

A total of 31 cases of horseshoe kidney transplantation have been described in the literature [5]. Because of the technical challenge involved in transplanting this type of kidney and their low frequency, some surgeons seem to be reluctant to use horseshoe kidneys for transplantation. In this study, the opinions of 112 surgeons in the field of kidney transplantation were analyzed. The reluctance to use horseshoe kidneys for transplantation is shown by the fact that 65.2% of the surgeons had explanted a horseshoe kidney, of which at least 21.9% were discarded. However, only 8.9% of the surgeons

would refuse a horseshoe kidney when offered. Only a few surgeons would transplant the horseshoe kidney en bloc or split it beforehand (22.5% and 18.6%, respectively). Most (58.8%) would let their decision depend on one or more parameters. The decision of most surgeons in both groups depended on the number and position of the renal arteries. Bearing in mind the often complex vascular anatomy, it seems to be advisable to transplant a horseshoe kidney en bloc when a considerable number of vascular anastomoses are to be made, as was suggested by several authors [4, 5]. This would make the transplantation technically less demanding. Another parameter on which the decision to transplant en bloc or after division depended was the anatomy of the urinary collecting system. Injury to the urinary collecting system has often been described as a complication of division of the renal isthmus as a treatment of ureteropelvic junction obstruction in horseshoe kidneys [2]. This often leads to urinary fistula formation, which is difficult to treat [2]. Some surgeons would let their decision whether to split or not to split depend on the morphology of the renal isthmus. When the renal isthmus is fibrous or consists of a small parenchymal mass, there is a low risk of damage to the urinary collecting system or of post-transplant hemorrhage after division. Although the latter complication is seen with some frequency [2, 5], it can easily be avoided by using adequate hemostatic techniques. This could be done by making a cone-like excision out of the parenchymatous wound, after which the wound edges can be approximated and the renal capsule closed over it [4, 5]. Two surgeons mentioned the anatomy of the veins as a factor on which their decision would depend. This seems to be very wise since there is also a great variation in the venous anatomy [3]. Most surgeons would explant a horseshoe kidney en bloc (91.2%). As suggested by some authors [4, 5], this seems to be the best decision. Two surgeons proposed that it would limit the cold ischemic time if the horseshoe kidney was split in situ. However, the disadvantage of a limited overview for careful inspection of the often complex vascular anatomy would create the risk of severing renal vessels while dividing the horseshoe kidney. Most surgeons (59.8%) were not interested in testing the anatomy of the renal isthmus and the urinary collecting system before division. All other surgeons (40.2%) favored diagnosing the anatomy of the urinary collecting system by retrograde injection of either a radio-opaque contrast medium or methylene blue into the ureters or by probing the ureters. Although the renal calices of both systems are rarely connected and it rarely occurs that a calyx overrides into the contralateral part of the horseshoe kidney [5], it would nonetheless be wise to diagnose the anatomy of the urinary collecting system. The diagnostic procedures mentioned above are very simple and can provide a good indication of where to divide the renal isthmus

without risking urinary fistula formation. Most surgeons (71.4%) consider the post-transplant results of horseshoe kidneys to be equal to those of kidneys with a normal anatomy. A literature review shows that this is most likely [5]. Some surgeons (23.2%) think the post-transplant results of horseshoe kidneys are worse than those of normal kidneys. Their opinion is probably based on the assumption that the technically demanding transplantation will cause a higher chance of primary non-function based on thrombosis of one or more of the renal arteries or veins. Only a small number of surgeons (5.4%) were of the opinion that horseshoe kidneys function better than normal kidneys. This could be true in en-bloc-transplanted horseshoe kidneys. Since more kidney mass (i.e. a higher number of nephrons) is transplanted into the recipient, it is to be expected that patients with en-bloc-transplanted kidneys would have lower post-transplant serum creatinine values than the recipients of a single normal kidney [1]. It is remarkable that there were no differences between the opinions of surgeons who had experience in the transplantation of horseshoe kidneys and those who did not.

Conclusion

Based on current opinions, transplant surgeons would advise accepting a horseshoe kidney when offered for transplantation. It should be explanted en bloc, after which it can be closely inspected on the back table. The decision to transplant it en bloc or after division of the renal isthmus depends on the morphology of the renal isthmus, the number and position of the renal vessels and/or the anatomy of the urinary collecting system. Although not advised by most surgeons, we think that it is important to diagnose the anatomy of the urinary collecting system through a retrograde pyelogram before dividing the renal isthmus. Although no evidence exists, most transplant surgeons within the ESOT consider the results of horseshoe kidney transplantation to be equal to those of kidneys with a normal anatomy.

Acknowledgements The authors would like to thank the members of the European Society for Organ Transplantation who participated in this study.

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