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Subclavian vein stenosis. Surgical strategies of management

Catheterization of subclavian vein is unfortunately still quite preferred method of temporary vascular access for hemodialysis. Especially in small, peripheral dialysis centers, where providing the access via internal jugular vein is avoided. The consequence of subclavian vein catheterization is its thrombosis or hemodynamically significant stenosis. Subsequent creation of arterio-venous fistula, located distally to the place of stenosis results in a continuous increase of venous pressure during dialysis, inadequacy of dialysis, venous and lymphatic stasis which leads to massive oedema of the extremity. This situation requires correction of existing subclavian vein stenosis or occlusion to maintain the functionality of the created arterio-venous fistula.

The aim of the study is to present surgical strategies of management of subclavian vein stenosis or thrombosis in hemodialysed patients.

MATERIAL AND METHODS

Between the years 2000–2004, 15 patients (nine men and six women) with forearm or upper arm arterio-venous fistula and coexisting ipsilateral stenosis or occlusion of subclavian vein were operated in the Department of Transplantation of the Queen Elizabeth Hospital in Adelaide / Australia and the Department of Vascular Surgery and Angiology in Lublin. Every patient was temporarily hemodialysed via subclavian catheter in the past. Seven patients were dialysed through brachio-cephalic fistula, three patients through two stage brachio-basilic fistula and three patients through radio-cephalic fistula. In two patients dialysis was performed through the synthetic arterio-venous graft on the forearm. All patients presented with oedema of upper extremity, high venous pressures and inadequacy of hemodialysis due to the presence of subclavian vein stenosis or thrombosis ipsilaterally to the fistula.

During qualification of the patients for surgery, the fistulograms with visualization of central veins were performed and internal and external jugular veins patency was verified by the ultrasound color Doppler. Based on the performed examinations, four typical locations of stenosis or thrombosis of subclavian vein were identified: junction of cephalic vein with subclavian vein – site I; between the junctions of cephalic and external jugular vein with subclavian vein – site II; between the junctions of external and internal jugular vein with subclavian vein – site III; and in brachio-cephalic vein – site IV (13).

Depending on the localization of stenosis/occlusion of subclavian vein and patency of jugular veins the surgical strategies of management involved: site I: local excision of stenosis of cephalic vein and its proximal reimplantation to the subclavian vein (five patients), site II: transposition of external jugular vein as the by-pass to cephalic, subclavian or axillary vein (four patients), site III: prosthetic by-pass between cephalic / basilic, subclavian or axillary vein and ipsilateral internal jugular vein (three patients), site IV: prosthetic by-pass between cephalic / basilic, subclavian or axillary vein and contralateral internal jugular vein (2 patients). In one patient, after stage I of brachio-basilic fistula and concomitant occlusion of ipsilateral brachio-cephalic vein, the anterotransposition of basilic vein (stage II) with its elongation by vascular prosthesis up to contralateral internal jugular vein was performed.

RESULTS

In all of the patients, during postoperative period a long-term improvement in dialysis adequacy, decrease of venous pressures and disappearance of oedema was achieved. Nine from 15 vascular accesses are still in use. Two fistulas required ligation – one due to torrential bleeding after pseudoaneurysm rupture and the other because of the switch from hemodialysis to peritoneal dialysis. Two fistulas thrombosed and attempts at thrombectomy were unsuccessful. Two patients received the kidney transplant. During the follow-up, four patients required the secondary angioplasty of central veins: two patients developed stenosis in the area of proximal anastomosis of vascular prosthesis with internal jugular vein; two patients had angioplasty of brachio-cephalic vein with stent. In three cases, the surgical correction of the fistula was performed: one thrombectomy and two reconstructions of distal part of the draining vein due to steal syndrome and pseudoaneurysms.

DISCUSSION

Catheterization of subclavian vein to provide the temporary access for hemodialysis is the most frequent cause of its subsequent stenosis or thrombosis. The frequency of subclavian vein stenosis as a result of the presence of catheter in its lumen varies from 15 to 50% of the patients (2, 9, 8). Because of the development of collaterals, the stenosis often remains asymptomatic until the permanent vascular access for hemodialysis is created distally from the stenosis or occlusion. As a result, it evokes an increase of venous pressure, affects the adequacy of dialysis and leads to oedema of the upper extremity.

Percutaneous angioplasty is considered by many authors as the first choice of treatment of subclavian vein stenosis (14). This method is characterized by relatively low percentage of significant complications and possibility of ambulatory performance. However, the literature points to different efficacy of endovascular procedures in maintaining the patency of central veins (3, 6). On the other hand, some authors underline that surgical by-passing of central veins stenosis should be still considered as the gold standard (11). The others indicate that both treatment approaches are univocal (1).

Despite described in this paper strategies of surgical management of subclavian vein stenosis, there are reports of some other surgical solutions. They involve: direct reconstruction of subclavian vein patency in its proximal segment, but the method requires claviclectomy to obtain good exposure (5); by-passing of the stenosis by implantation of saphenous vein from subclavian / axillary vein to internal / external jugular vein (7); implantation of vascular graft from subclavian / axillary vein to superior vena cava (12) or right atrium (4); implantation of vascular graft from axillary vein to ipsilateral saphenous vein (10). We underline the necessity of strict mutual cooperation between nephrologist, surgeon and interventional radiologist when the decision is made how to treat the subclavian vein stenosis.

In the described above cases, an alternative endovascular treatment should consist of balloon angioplasty in stenoses located in sites I, II, III and angioplasty with stent in site IV. Dilatation of stenosis in site I is a sufficient way of treatment. Additional placement of stent in site II and III seems to be less indicated, because the proximity of clavícula and working muscle mass may lead to deformation and destruction of the stent structure. Especially that the patency rates in case of angioplasty alone and angioplasty with stent are comparable (15). It is worth to say that endovascular procedures are extremely useful in correction of secondary stenoses in surgical by-passes.

CONCLUSIONS

Despite the dynamic development of endovascular techniques, surgical strategies of management of central vein stenoses are valuable and efficient methods of maintaining accurate function and patency of vascular access for hemodialysis.

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SUMMARY

Between the years 2000–2004, 15 patients with forearm or upper arm arterio-venous fistula and coexisting ipsilateral stenosis or occlusion of subclavian vein were operated in the Department of Transplantation of the Queen Elizabeth Hospital in Adelaide / Australia and the Department of Vascular Surgery and Angiology in Lublin. Every patient was temporarily hemodialysed via subclavian catheter in the past. All presented with upper extremity oedema, high venous pressures and inadequacy of hemodialysis. Depending on the localization of stenosis/occlusion of subclavian vein and patency of jugular veins the surgical strategies of management involved: 1) local excision of stenosis of cephalic vein and its proximal reimplantation to the subclavian vein (5 patients), 2) transposition of external jugular vein as the by-pass to cephalic, subclavian or axillary vein (4 patients), 3) prosthetic by-pass between cephalic / basilic, subclavian or axillary vein and *ipsi* – or contralateral internal jugular vein (6 patients). In all of the patients, long-term improvement in dialysis adequacy, decrease of venous pressure and disappearance of oedema was achieved. Nine from 15 vascular accesses are still in use. Despite rapid development of transluminal angioplasty techniques in the treatment of central venous stenoses, surgical management strategies are still a very valuable option of maintaining the functionality and patency of vascular access for hemodialysis.

Zwężenie żyły podobojczykowej. Chirurgiczne strategie postępowania

W latach 2000–2004 na Oddziale Transplantacji Szpitala im. Królowej Elżbiety w Adelaidzie (Australia) i w Katedrze i Klinice Chirurgii Naczyń i Angiologii w Lublinie operowano łącznie 15 pacjentów z przetoką tętniczo-żylną na ramieniu lub przedramieniu i ze współistniejącym zwężeniem lub niedrożnością żyły podobojczykowej po stronie dostępu naczyniowego. Wszyscy pacjenci byli w przeszłości czasowo dializowani przez cewnik podobojczykowy. U każdego obserwowano obrzęk ramienia, wysokie ciśnienia powrotu żylnego oraz upośledzenie adekwatności dializy. W zależności od lokalizacji zwężenia bądź niedrożności żyły podobojczykowej oraz drożności żył szyjnych zewnętrznych i wewnętrznych strategie postępowania chirurgicznego obejmowały: 1) wycięcie zwężenia w ujściu żyły odpromieniowej do żyły podobojczykowej i proksymalną reimplantację żyły odpromieniowej do żyły podobojczykowej (5 pacjentów), 2) transpozycję żyły szyjnej zewnętrznej i wykorzystanie jej jako pomostu naczyniowego do żyły odpromieniowej, podobojczykowej lub pachowej (4 pacjentów), 3) pomostowanie z użyciem protezy naczyniowej pomiędzy żyłą odpromieniową, podobojczykową lub pachową a *ipsi* – bądź kontralateralną żyłą szyjną wewnętrzną (6 pacjentów). U wszystkich chorych osiągnięto długotrwałą poprawę stanu miejscowego, spadek ciśnienia żylnego dializy oraz wzrost jej adekwatności. Z 15 obserwowanych przetok 9 było nadal używanych. W dobie dynamicznego rozwoju technik angioplastyki przezskórnej strategie postępowania chirurgicznego ze zwężeniami żył centralnych stanowią ciągle wartościową i skuteczną metodę zapewnienia prawidłowej funkcji i drożności dostępow naczyniowych do dializ.