Endovascular Management of Flush Common Iliac Artery Occlusive Disease: Challenges and Solutions

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Abstract

The aim of this study was to assess the difficulties met with possible recommendations in management of flush common iliac artery occlusive disease (FCIAOD).

This a prospective study assessing FCIAOD along the period of 24 months. We defined FCIAOD as more than 90% occlusion of diameter of common iliac artery (CIA) with less than 2 mm patent iliac stump from its origin from the abdominal aorta.

Our study included 51 cases. Technical success was achieved in 47 patients (92%); 82.5% of cases were done via two accesses (65% of cases were done using bilateral femoral). Primary stenting was done in all cases. Sixty-eight percent of cases were treated by unilateral stents (81.3% of them were done using self-expandable) and 32% of cases were treated by kissing stents (50% using self-expandable). Pre-stent dilatation was selectively used in 77% of cases. Follow-up (12 months) revealed primary patency of 82.5% and secondary patency was 98% with no amputation done. Mortality rate was 4%. Endovascular treatment provides a successful option for the management of FCIAOD with a technical success rate of 92%, the option of selective use of pre-stent dilatation. FCIAOD does not preclude the use of unilateral stent in CIA, which can be completed to kissing stents if needed.

Keywords

- endovascular
- common iliac
- ostial lesion
- flush
- kissing stents
- dissection
- predilatation

Lesions involving the origin of the common iliac artery (CIA) at aortic bifurcation deserve extra consideration. The main concern is that intervention on one side may compromise the origin of other iliac by movement of an eccentric plaque. One option is the kissing stent technique where stents are placed in bilateral iliac arteries.¹

This technique (iliac angioplasty) is applicable not only to chronic ischemia but also to acute limb ischemia. Iliac angioplasty has been used not only as a stand-alone procedure but also as a viable option for improving inflow in patients requiring distal bypass procedures.²

Combined use of iliac artery angioplasty and infrainguinal surgical revascularization is an effective and durable way of treating multilevel atherosclerotic disease.³

Objective

The study aims at assessment of technical success rate and the patency rate (short term) of the endovascular option for treatment of these lesions with review of the role of kissing stents and unilateral stent in treatment of these lesions. In addition, it also studies assessment of the techniques used with review of complications and methods of management.

Patients and Methods

This a prospective study of patients presented to us over a period of 3 years. Flush CIA occlusive disease (FCIAOD) is defined as more than 90% occlusion of diameter of CIA with

less than 2 mm patent iliac stump from its origin from the abdominal aorta (►Fig. 1A–D). All patients with chronic atherosclerotic FCIAOD presented by claudication, rest pain, or tissue loss were included in the study. Patient presented with embolic disease, acute thrombotic ischemia, trauma, autoimmune disorders or arteritis, or connective tissue disorder (system lupus erythematosus [SLE], Behcet) were excluded from the study.

Patients presented were subjected to meticulous physical examination, routinely done duplex, and selectively done computed tomography angiography (CTA) and/or conventional angiography. Each patient was assessed for epidemiological features, risk factors, clinical presentation, meticulous clinical examination, imaging used, and presence of other occlusive arterial disease evident by examination, duplex, technique, and complications. Follow-up by means of clinical examination and duplex study after 6, 12, 18, and 24 months of follow-up.

Table 1 Age distribution

Age	Percentage (%)
40–50	4.6
50–65	90.7
65–83	4.6

Results

This is a prospective study of 51 cases with FCIAOD. Age varied between 40 and 83 years with mean age of 61 years (►Table 1). Most of the patients included in the study were male (79%), while female were (21%). Many comorbidities are encountered in the included patients as shown in ►Table 2. Most of the patients presented by tissue loss 24 cases, while

Fig. 1 (A–D) Flush common iliac artery occlusions (arrow).

Table 2 Associated comorbidity distribution

Associated comorbidity	Percentage (%)
1) Smoking	76.7
2) Diabetes	76.7
3) Hypertension	67.4
4) Hyperlipidemic	41
5) Renal impairment	16
6) Cardiac patient	18
7) COPD	4

Abbreviation: COPD, chronic obstructive pulmonary disease.

16 cases with incapacitating claudication and rests pain was in 11 cases.

Clinical examination revealed that ipsilateral weak femoral pulse in 12 cases, ipsilateral absent femoral pulse in 28 cases, bilateral absent femoral pulse in 11 cases, and presence of scar of previous operation in 1 case.

Preoperative investigations include Duplex that was done in all cases, while CTA was done in 15 cases. Other arterial occlusive diseases are shown in ► **Table 3**.

The two femoral arteries were used as the main access in 63% of cases (► **Table 4**). The main wires used were hydrophilic Terumo (Terumo Medical Corporation, Belgium) in 51 cases, while V 18 was used only in 11 cases. Pre-stent dilatation was used in 77% of cases.

Technical success was achieved in 47 patients (92%); 82.5% of cases were done via two accesses (65% of cases were done using bilateral femoral).

Primary stenting was done in all cases; 68% of cases were treated by unilateral stents (81.3% of them were done using self-expandable) and 32% of cases were treated by kissing stents (50% using self-expandable).

Follow-up (24 months) revealed primary patency of 82.5% and secondary patency was 98% with no amputation done. Forty-two cases were patent with no residual stenosis (82.5%). Four cases restenosis and one case occluded unilateral stent, three cases were treated by percutaneous transluminal angioplasty (PTA) alone, one case was treated by PTA and stenting using ipsilateral retrograde femoral access, and one case was treated by restent using bilateral access. Two cases of occluded contralateral iliac artery were treated: one treated by surgery, while the other one was treated by insertion of kissing stents. One case developed a stenosed contralateral iliac that was treated by kissing stents.

Table 3 Multilevel disease

Associated occlusion	Percentage (%)
Contralateral common iliac artery	16
Ipsilateral external iliac artery	25
Ipsilateral superficial femoral artery	28
Ipsilateral crural disease	16

Table 4 Access used

Access used	Percentage (%)
ipsilateral femoral retrograde only (one access)	4
Contralateral femoral only (one access)	9
Transbrachial only	7
Ipsilateral and contralateral femoral (two accesses)	63
Transbrachial and ipsilateral retrograde femoral (two accesses)	16

Overall, secondary patency rate after 24 months was 98%. Mortality rate was 4%. Minor complications included groin hematoma in four cases, dye allergy in two, and balloon-mounted stent prematurely deployed in external iliac artery (EIA) with no adverse effect.

Discussion

The aorta and the iliac arteries have become a primary field for percutaneous intervention. Easy access and relatively large diameter of target vessels and the usually benign outcome of major complications have contributed to the wide acceptance of percutaneous intervention in this area.⁴

FCIAD deserves extra considerations. Concern exists about which access should be used, how to tackle the lesion (from above or below), and whether to use unilateral or kissing stents.

The current study is designed to deal with 51 cases of FCIAD in the recent era as regard with access, technique, tools, stents, results, and complications.

The age distribution in the current study reflects the higher prevalence of aortoiliac occlusive disease in old age with the mean age of 61 years which coincides with most of the literature with the mean age ranged between 59 and 60 years.⁵⁻⁸

This may be explained by high incidence of aortoiliac atherosclerosis with advance of age especially in the sixth decade of life. Yet, the study by Lawrentschuk et al conducted in Australia showed a slightly higher mean age of 67 years (range: 44–81). This may be due to that this study was conducted only on stenosis plus the different geographical distribution may have attributed to this slight difference.⁹

In the current study, male patient constituted approximately 80% of all patients which was by far higher than stated in the literature which ranged from 45 to 68%.^{5,6,8,10-12} On the contrary, male constituted 74% of cases in the study conducted by Lawrentschuk et al.⁹ This may be attributed to the prevalence of predisposing factors (smoking, hyperlipidemia, stress of life, and hypertension) in the male population.

In the current study, the main associated comorbidity was 76% smokers and diabetic, while 67% were hypertensive. Other associated diseases include hyperlipidemic (41%) and cardiac patient (18%). This may be attributed to increasing comorbid conditions with advanced age.

Table 5 Associated comorbidity NA

Associated comorbidity	Current study	Timaran et al	Björkses et al	Greiner et al	Mouanoutoua et al.	Balzer et al
Smoking	33	85	58	56	67	77
Hypertension	29	70	45	32	42	84
Diabetes	33	40	18	16	29	44
Hyperlipidemia	19	NA	NA	24	38	78
Cardiac compromise	8	60	26	NA	67	15
Renal insufficiency	7	NA	NA	NA	NA	9

Abbreviation: NA, not available.

As shown in **Table 5**, the current study results coinciding with Timaran et al in the incidence of smoking and hypertension, and this may be attributed to increased incidence of atherosclerosis with these risk factors while different Mouanoutoua et al, Balzer et al, and Björkses et al in incidence of diabetes, hyperlipidemia, and cardiac compromise. Yet, we have higher incidences of diabetes than that were mentioned in the literature that may be due to increased life stress and obesity.^{7,8,12}

In the current study, the main presentation was tissue loss (48%) and claudication (37%). Nearly 4% were rest pain. This is different than all the literature as shown in the table, the patients being mostly claudicants ranging from 58 to 79%. This may be attributed to paradigm shift of indication of vascular intervention in the European community to include the claudicants and not just critical limb ischemia.^{7,8,12}

In the current study, associated EIA disease (25%), superficial femoral artery (SFA) (28%), and crural disease (16%) were coinciding with Mouanoutoua et al where associated EIA disease was 26%, SFA 8%, and crural 22%.⁷

In this study, different accesses were used in each individual according to each case and the usage of two accesses was the majority of cases constituting approximately 80% of cases. Bilateral femoral access was used in 64% and brachial and ipsilateral femoral in 16% of cases, while one access was used in 20% of cases, either brachial or ipsilateral femoral access was used. Brachial approaches when contralateral crossover technique fails or is not appropriate due to bilateral disease. Brachial approach allowed a direct line for recanalization and also helped increase the torque that could be applied to the guide wire. FCIAOD has no nipple; therefore, sometimes, it has difficulties in passing the lesion by use of contralateral approach as wire and catheter slipped in aorta as lacking the required support. In the literature, there are controversies about access to FCIAOD which may be different to access to middle part of CIA occlusion as in the literature.^{13,14}

Bechara et al have advocated a new technique that facilitates the antegrade negotiation of FCIAOD. The technique involves placing an occlusive contralateral iliac artery balloon to assist in recanalizing a flush iliac artery occlusion, thus avoiding the expensive re-entry devices.¹⁵

In Balzer et al and Treiman et al, the preferred approach in complete occlusion is to pass the lesion by contralateral approach, then all procedures as debulking and stent insertion were done from ipsilateral retrograde femoral.^{8,16}

Although using only retrograde ipsilateral femoral approach was preferred access used by Ballard et al, Sullivan et al, and Brountzos and Kelekis as it is short, straight, and successful in 80% of cases, yet it has several disadvantages that were mentioned by Thava et al, as it usually creates subintimal dissection which will be a problem in re-entry as thickened aortic intima heralds the re-entry and also dissection may reach to renal and lumbar causing serious effect.^{2,13,17,18}

Therefore, we prefer to better use of two accesses even in unilateral disease either contralateral femoral access or brachial access to do angiography and crossing the lesion, while ipsilateral retrograde femoral used to insert the stent as the end near origin of iliac artery will be deployed first allowing proper and precise insertion meanwhile allowing the usage of self-expandable stent with a great accuracy. In addition, advantages of using two accesses are to do angiography from contralateral approach allowing good planning of work and with the presence of bilateral access, it is easier to convert the procedure to kissing stents as required. It is also possible to use flossing technique which is passage the wires from the contralateral side and crossover then crossing the lesion and picking up the wire from ipsilateral femoral sheath (may be facilitated by a snare but possible without). Thus, there will be a secure passage of balloons and stents. Angiography can still be done by passage of a catheter from the contralateral femoral over a body wire (this usually requires a larger sheath). Flossing technique were also used by Cilingiroglu et al by aid of a snare, it facilitated subintimal recanalization of iliac artery occlusion.¹⁹

In the current study, pre-stent dilatation was used in 74.5% of cases. Gaines advised not to predilate since this decreased the risk of distal embolization. Also, there is some evidence that this results in less intimal hyperplasia. On the contrary, Brountzos and Kelekis, Lumsden et al, Criado et al, and Schneider advocated present dilatation.^{18,20-23} Present dilatation had several advantages. It facilitates the second femoral ipsilateral puncture and makes a smooth passage of stent without insult the plaque and allow better sizing of the stent and balloon needed. Predilatation of stenosis was advised especially when very tight lesion as it will enlarge the lumen enough to allow subsequent crossing with long sheath. Meanwhile, it assesses the dilatability of lesion because balloon expansion cannot be assessed. There are some very hard calcific stenoses that may not be amenable to balloon

angioplasty at all to find this out when the stent is on the balloon will lead troubles. Predilation can be done by same balloon that will be used for stent deployment or slightly smaller (1–2 mm) under size the stent.²² In addition, it allows the proper selection of size and length of the subsequent stent placement.²¹ Predilating the lesion is usually advisable if the residual lumen is severely restricted, the stent may not expand sufficiently to allow placement of a poststent balloon angioplasty catheter.²⁴

In the current study, routine stenting were used in all cases that were all treated for occlusion. Routine stenting is coinciding with were mentioned in the literature. Poncylyusz et al and Uberoi and Tsetis advocated routine stent placement.^{21,25} Routine stenting of the flush CIA occlusion should be always practiced as calcification and irregular and dissection that occur when PTA alone done. In addition, stenting is recommended for in total occlusion primary. This is because calcified lesions typically occurring at the aortic bifurcation are not amenable to balloon dilatation alone.¹⁷ Other advantages of routine stenting are reduction in distal embolization by trapping atheromatous plaque and clot between the stent and the arterial wall, shorter procedural time and decreased radiation exposure.^{17,25} In addition, stent implantation at the ostia appears to be theoretically beneficial as the ostia are prone to severe atherosclerotic changes with extensive calcification.²⁶

In a study mentioned by Jindal et al, 2 years primary and secondary patency rates were higher following stenting when compared with PTA (77 and 88% vs. 64 and 80%).²⁶ While in a study mentioned by White et al that advocated PTA with selective stenting as it has the same results of stenting. The reason behind selective stenting is that it is cost effective than primary stenting. Yet, they did not include all iliac ostial lesion and most of the study were dealing with stenosis not complete occlusion.

In current study, self-expandable stents were deployed in 75% of cases, while balloon-mounted stents were deployed in 25% of cases. In Balzer et al, self-expandable stents were used in 43% of cases, balloon expandable in 54%, and covered stents in 3% of their cases (the covered stents were used to seal perforation). The flexible self-expanding nitinol stents were used for crossover techniques and tortuous vessels and long lesions while balloon-expandable stents (with the stronger radial expansion were used in extremely calcified stenosis and especially CIA occlusions.⁸ In Kudo et al, balloon-expandable stents were used in (85%), and in Sullivan et al, balloon expandable (85.7%) or self-expanding (14.3%). The reason of more used balloon-expanding stents may be attributed to the more stenotic lesions included in their study range from 80 to 90%; therefore, they used ipsilateral femoral and not crossover so balloon mounted were easier. In Mendelsohn et al, balloon-expandable stents were used only as they only treated stenotic lesions near aortic bifurcation; therefore, precise placement was needed and ipsilateral femoral access was easier.²⁷ Haulon et al used self-expanding stents in 58.5% of patients and balloon-expandable devices in 41.5% of patients.²⁸

Apart from availability and familiarity with specific devices, selection of a stent type for iliac artery depends on tortuosity of iliac arteries, the size of introducing sheath,

and mainly the lesion's characteristics determine the appropriate stent type. Eccentric and short calcific lesions typically occurring at aortic bifurcation are likely best treated by balloon-expandable stents. On the contrary, whenever the stent should follow a tortuous path, or is to be placed from contralateral side over the aortic bifurcation, self-expandable stents are recommended because of their flexibility. The fear from usage of self-expandable stents is that they may shorten, however, this fear is reduced with the new stent types and designs.^{17,29}

For aortic bifurcation disease self-expanding nitinol stents are preferred as they are flexible and can adapt to the angle between the aorta and the iliac arteries. Balloon-expandable stents are used when accuracy is required to place the stents in such a manner that the proximal end of the stent is flushed with the ostium of the CIA.²⁶

In our opinion, self-expandable stents are preferred in aortic bifurcation lesions with tortuosity in iliac artery as it is more flexible and can be protruded in aorta and can be done from contralateral side. While balloon mounted are preferred if precise placement near origin of CIA ostium that would not protrude in aorta and heavily calcific lesions.

Besides, currently, there is no clinical evidence of any long-term advantage of one type of stent over the others. The choice of the stent is tailored to the lesion to be treated. Balloon-expandable stents have excellent hoop strength and are best for focal lesions or orifice lesions. Self-expanding stents are more flexible and are useful for long lesions or tortuous arteries.

In the current study, unilateral iliac stent were deployed in 65% of cases while bilateral kissing stents were deployed in 35% of cases. Kissing stents were preferred for the lesions that extend to aortic bifurcation and bilateral disease as it is more effectively trapping the lesions that commonly occur at the aortic carina.

Brountzos and Kelekis recommended the use of simultaneous balloon dilatation at the origins of both CIAs is advocated, even in the presence of unilateral lesion, to protect the contralateral CIA from dissection or plaque dislodgement, with subsequent embolization. Because calcified lesions typically occurring at the aortic bifurcation are not amenable to balloon dilatation alone, "kissing stents" or "aortic reconstruction" technique is applied, the aortic bifurcation reconstruction technique is technically very successful.¹⁷ Mohamed et al advocated kissing stents and stated that there were no long-term occlusions following kissing stents in a previously nonsymptomatic/nondisease limb.³⁰ Because lesions with irregular contours, calcification, and haziness may be especially prone to contralateral displacement during unilateral dilation, kissing stents were used to treat these complex plaques, even when they were predominantly unilateral.²⁷

However, Smith et al in a recent retrospective review of patients undergoing percutaneous treatment of unilateral CIA occlusive lesions challenged this long established practice. One hundred seventy-five patients with unilateral ostial lesion of CIA were treated with PTA or stenting without contralateral protection: only 2 patients did the contralateral unprotected CIA develop mild stenosis, 17% and 24%, respectively. The

authors concluded that protection of contralateral CIA during PTA or stenting in proximal CIA is not mandatory.³¹

Lawrentschuk et al advocated also unilateral stent. They justified that as no extra balloon nor stents, thus reducing the cost. In addition, potential arterial wall damage and no arterial compromise where the sum of two balloons exceeds the diameter of the adjacent aorta and with no need to perform a further catheterization with reduction of the cost. They concluded that the use of single balloon technique is a safe alternative to the "kissing balloon" technique for PTA of the proximal CIA.⁹

In the current study, technical success (evident by return of distal pulse and good refilling in completion angiography) was achieved in 92% of cases. This result is near to what were mentioned by Leville et al that was 94% and Scheinert et al that was 90%, but higher than Greiner et al where technical success was achieved in 86% of their cases. This may be due to that they include more lesions transatlantic intersociety consensus (TASC) D 72% of their cases adding more difficulties in crossing the lesion.³²

Although this technical success was lower than other studies that ranged from 97 to 100%.^{5-7,25,27,30} This difference may be attributed to difference in technique and types of lesions where technical success is higher in stenosis than occlusion and also the use of adjunctive methods for recanalization as laser and re-entry devices that may increase the technical success.

In the current study, during the period of follow-up of 24 months, the primary patency of cases was 80%, while secondary patency was 97.5%. Restenosis occurs in 10% of cases and one case with occluded stent complicated contralateral iliac artery occurs in 7.5%. Ostia of major arterial branches, such as the aortic bifurcation, are prone to severe atherosclerotic changes of the vessel wall with extensive calcification.⁵ Thus, angioplasty with stent placement in this area may have an increased risk for restenosis.¹⁹

As shown in **Table 6**, 24 months patency rate of current study is lower than mentioned in the literature. This may be explained that most of the lesions that were dealt with in the

current study were complete occlusion (i.e., TASC C and D) which have poorer long-term results in contrast to other studies that were dealing with stenotic lesions with better long-term patency. Also, associated infrainguinal diseases which would adversely affect the outcome as SFA lesion were 28% of cases in current study.

In 2005, Schnieder concluded that good runoff was a strong predictor of success after iliac PTA (73% at 3 years vs. 30% for poor runoff). However, in a study done by Scheinert et al concluded that concomitant infrainguinal arterial reconstruction does not improve iliac stent patency in patients undergoing iliac artery stenting with poor distal runoff. Therefore, infrainguinal bypass procedures should be reserved for patients who do not demonstrate clinical improvement after pelvic recanalization. Yet, there are several potential limitations to this study. First, it is a retrospective observational study, with the potential bias and confounding effects inherent in all observational studies. Second, they included patients from two busy institutions with ample experience in both endovascular and peripheral reconstruction and the number of patients was small and prevented further stratified analysis.³³

In current study, complications in the contralateral CIA occurred in 7.5% of the cases during insertion of unilateral stent.

In contrast to our results on unilateral stent in iliac artery origin, in a study mentioned by Lawrentschuk et al (2003), there were no major complications in contralateral CIA with the use of unilateral angioplasty without protection of other side. This may be contributed to misplacement of stent that may protrude in the aorta and progression of atherosclerotic disease that occur at the bifurcation and these studies were conducted on stenotic lesions and focal aortoiliac occlusive disease, while our study conducted mainly on complete occlusions.⁹

Our recommendation that when unilateral iliac stent will be inserted, it must not protrude in the aorta and instead it must be just flushed with the origin of CIA as protruding unilateral iliac stent in the aorta adversely affects the patency rate and outcome.

Table 6 Comparison of published data concerning TS and patency rates of iliac artery and superficial femoral artery lesions NA

Study	TS %	Patency rate %				Complication %
		6 mo	12 mo	24 mo	36 mo	
Timaran et al	96	NA	90	NA	74	NA
Scheinert et al	90	NA	84	81	78	NA
Balzer et al	96	NA	NA	NA	86	6, 9
Mohamad et al	NA	NA	81	58	NA	4
Björnses et al	NA	NA	97	88	83	NA
Haulon et al	NA	NA	NA	90	NA	NA
Hallet et al	NA	1ry 92 2ry 95	87 94	83 90	78 88	NA
De Roeck et al	NA	1ry 97 2ry 97	95 96	88 93	82 91	NA
Griener et al	86	94	91	65	NA	NA

Abbreviations: NA, not available; TS, technical success; 1ry, primary; 2ry, secondary.

Conclusion

Endovascular treatment provides a successful option for the management of FCIAOD with a technical success rate of 92%. Technical consideration includes the use of two accesses as a rule and the option of selective use of pre-stent dilatation. FCIAOD does not preclude the use of unilateral stent in CIA, which can be converted to kissing stents when needed.

References

- Peden E, Bush RL, Lumsden AB. Aortoiliac occlusive disease. [Book authors] Lumsden AB, et al. Endovascular Therapy Principle of Peripheral Intervention. Vol. 11. Massachusetts: Blackwell Publishing; 2006:170–184
- Ballard JL, Bergan JJ, Singh P, Yonemoto H, Killeen JD. Aortoiliac stent deployment versus surgical reconstruction: analysis of outcome and cost. *J Vasc Surg* 1998;28(1):94–101, discussion 101–103
- Ali AT, Modrall JG, Lopez J, et al. Emerging role of endovascular grafts in complex aortoiliac occlusive disease. *J Vasc Surg* 2003;38(3):486–491
- Vorwerk D, Guenther RW, Schürmann K, Wendt G, Peters I. Primary stent placement for chronic iliac artery occlusions: follow-up results in 103 patients. *Radiology* 1995;194(3):745–749
- De Roeck A, Hendriks JM, Delrue F, et al. Long-term results of primary stenting for chronic iliac artery occlusions. *Acta Chir Belg* 2006;106(2):187–192
- Scheinert D, Schröder M, Balzer JO, Steinkamp H, Biamino G. Stent-supported reconstruction of the aortoiliac bifurcation with the kissing balloon technique. *Circulation* 1999;100(19, Suppl):II295–II300
- Mouanoutoua M, Maddikunta R, Allaqaband S, et al. Endovascular intervention of aortoiliac occlusive disease in high-risk patients using the kissing stents technique: long-term results. *Catheter Cardiovasc Interv* 2003;60(3):320–326
- Balzer JO, et al. Management of arterial access site after percutaneous interventions. *Euro PCR* 2004:472–483
- Lawrentschuk N, Sary D, Miller RJ. Percutaneous transluminal angioplasty of stenosis at the common iliac artery origin using a single balloon technique. *EJVES Short Reports* 2003;5(4):55–56
- Leville CD, Kashyap VS, Clair DG, et al. Endovascular management of iliac artery occlusions: extending treatment to TransAtlantic Inter-Society Consensus class C and D patients. *J Vasc Surg* 2006;43(1):32–39
- Timaran CH, Stevens SL, Freeman MB, Goldman MH. External iliac and common iliac artery angioplasty and stenting in men and women. *J Vasc Surg* 2001;34(3):440–446
- Björnsen K, Ivancev K, Riva L, Manjer J, Uher P, Resch T. Kissing stents in the aortic bifurcation—a valid reconstruction for aorto-iliac occlusive disease. *Eur J Vasc Endovasc Surg* 2008;36(4):424–431
- Thava VR, Stead RE, Smith RP. Subintimal recanalisation and stenting of a common iliac artery occlusion by a left axillary and an ipsilateral femoral retrograde approach using modified gooseneck grab aided by balloon dilatation of “dissection port”. *Clin Radiol* 2004;59(6):527–530
- Papavassiliou VG, Walker SR, Bolia A, Fishwick G, London N. Techniques for the endovascular management of complications following lower limb percutaneous transluminal angioplasty. *Eur J Vasc Endovasc Surg* 2003;25(2):125–130
- Bechara CF, Barshes NR, Lin PH, Kougas P. Recanalization of flush iliac occlusions with the assistance of a contralateral iliac occlusive balloon. *J Vasc Surg* 2012;55(3):872–874
- Treiman GS, Schneider PA, Lawrence PF, Pevec WC, Bush RL, Ichikawa L. Does stent placement improve the results of ineffective or complicated iliac artery angioplasty? *J Vasc Surg* 1998;28(1):104–112, discussion 113–114
- Sullivan TM, Childs MB, Bacharach JM, Gray BH, Piedmonte MR. Percutaneous transluminal angioplasty and primary stenting of the iliac arteries in 288 patients. *J Vasc Surg* 1997;25(5):829–838, discussion 838–839
- Brountzos EN, Kelekis DA. Iliac artery angioplasty : technique and results. *Acta Chir Belg* 2004;104(5):532–539
- Cilingiroglu B, et al. Subintimal snare-assisted dissection for iliac recanalization: a potentially useful tool. *Vasc Dis Management* 2007;4(2):41–44
- Gaines PA. Iliac occlusive disease (indication for treatment, technical aspects, current results, and troubleshooting complications). [Book authors] Thompson MM, et al. Endovascular Intervention for Vascular Disease Principles and Practice. New York: Informa Healthcare USA, Inc; 2008:9–19
- Poncyjusz W, Falkowski A, Garncarek J, Karasek M, England S, Zawierucha D. Primary stenting in the treatment of focal atherosclerotic abdominal aortic stenoses. *Clin Radiol* 2006;61(8):691–695
- Lumsden AB, Lin PH, Bush RL, Chen C. Endovascular Therapy: Principles of Peripheral Interventions. London: Blackwell Publishing; 2006
- Schnieder PA. Endovascular surgery management of chronic lower extremity ischaemia. [Book author] Rutherford RB. Vascular Surgery. 6th ed. Vol 3. Philadelphia: Elsevier Saunders; 2005:1192–1223
- Schnieder PA. The infrarenal aorta, aortic bifurcation, and iliac arteries: advice about balloon angioplasty and stent placement. *Endovascular Skills: Guidewire and Catheter Skills for Endovascular Surgery*. 3rd ed. New York: Informa Healthcare; 2008
- Uberoi R, Tsetis D. Standards for the endovascular management of aortic occlusive disease. *Cardiovasc Intervent Radiol* 2007;30(5):814–819
- Haulon S, Mounier-Véhier C, Gaxotte V, et al. Percutaneous reconstruction of the aortoiliac bifurcation with the “kissing stents” technique: long-term follow-up in 106 patients. *J Endovasc Ther* 2002;9(3):363–368
- Kudo T, Chandra FA, Ahn SS. Long-term outcomes and predictors of iliac angioplasty with selective stenting. *J Vasc Surg* 2005;42(3):466–475
- Mendelsohn FO, Santos RM, Crowley JJ, et al. Kissing stents in the aortic bifurcation. *Am Heart J* 1998;136(4 Pt 1):600–605
- Kaufman JA. Vascular intervention. [Book authors] Kaufman JA, Lee MJ. Vascular and Interventional Radiology: The Requisites. St. Louis: Mosby; 2004:83–118
- Sproat IA. Percutaneous transluminal balloon angioplasty of the aorta and iliac arteries. [Book authors] Dacry MD, Vedantham S, Kaufman JA. Peripheral and Vascular Interventions. 2nd ed. St. Louis: SCVIR; 2001:179–204
- Mohamed F, Sarkar B, Timmons G, Mudawi A, Ashour H, Uberoi R. Outcome of “kissing stents” for aortoiliac atherosclerotic disease, including the effect on the non-diseased contralateral iliac limb. *Cardiovasc Intervent Radiol* 2002;25(6):472–475
- Smith JC, Watkins GE, Taylor FC, Carlson LA, Karst JG, Smith DC. Angioplasty or stent placement in the proximal common iliac artery: is protection of the contralateral side necessary? *J Vasc Interv Radiol* 2001;12(12):1395–1398
- Greiner A, Dessl A, Klein-Weigel P, et al. Kissing stents for treatment of complex aortoiliac disease. *Eur J Vasc Endovasc Surg* 2003;26(2):161–165