

Effectiveness of surgical banding for high flow in brachial artery- based hemodialysis vascular access

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Disclosure

Speaker name:

...Jan HM Tordoir.....

- I have the following potential conflicts of interest to report:
- Consulting
- Employment in industry
- Shareholder in a healthcare company
- Owner of a healthcare company
- Other(s)
- I do not have any potential conflict of interest



Indications for high flow access (HFA) treatment

- **Hemodialysis access-induced distal ischemia (HAIDI)**
pain; coldness; discolorisation; ulcers
- **HD patients presenting with cardiac failure**
orthopneu; tachypneu; tachycardia
- **Asymptomatic patients with persistent HFA**
usually brachial-based AVF with flow > 2 L/min



Vascular access-clinical practice guidelines

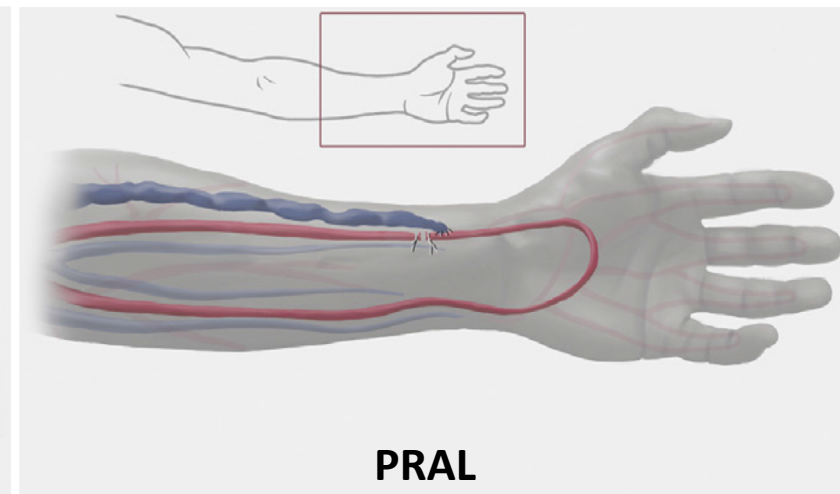
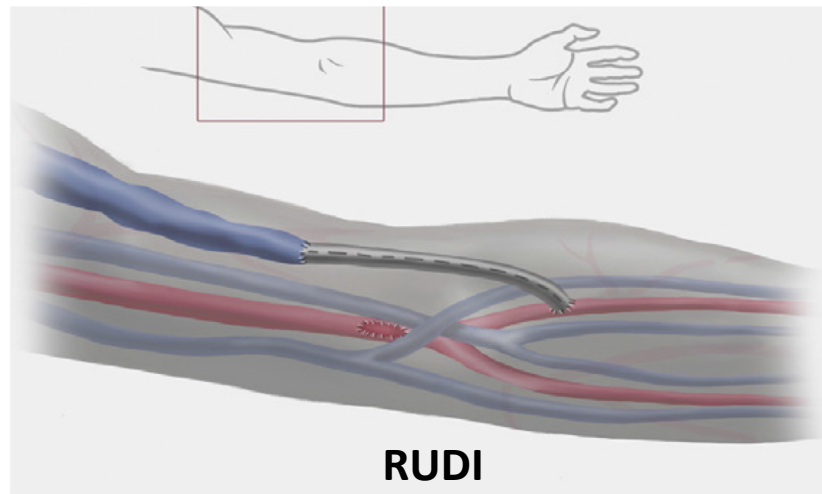
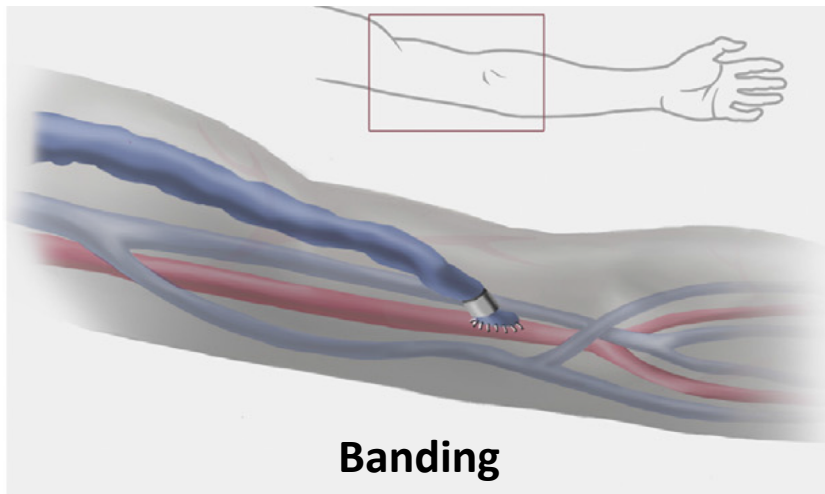
Strategy for high flow access

Topic	KDOQI (2006)	EBPG (2007)	ESVS (2018)
Intervention for high flow access	<p>High flow-induced steal syndrome requires a decrease in AVF flow volume.</p> <p>Banding procedures of the postanastomotic vein segment using different techniques as practiced in the past were not as successful as expected.</p> <p>It is more beneficial to decrease the diameter of the anastomosis or create a new AV anastomosis distally. The success of the procedure after surgery should be evaluated by using access flow measurements.</p>	<p><i>Guideline 9.2.</i> Enhancement of arterial inflow, access flow reduction and/or distal revascularization procedures are the therapeutic options for patients with <u>ischaemia</u>.</p> <p>When the above methods fail, access ligation should be considered (Evidence level II).</p>	<p><i>Recommendation 71</i> Symptomatic access-induced extremity <u>ischaemia</u> in patients with high flow access should be treated by surgical procedures aimed to reduce access flow.</p>



Strategy for high flow access

- Surgical flow reduction procedures



Brachial artery-based AVF

Radial artery-based AVF



Preoperative workup for HFA treatment

- **Adequate pharmaceutical bloodpressure regulation**
- **Arterial inflow & distal forearm angiography (HAIDI indication)**
- **Complete upper extremity vessel assessment with ultrasound**
- **Either ultrasound or Transonic flow measurement**
- **Saphenous vein mapping**
- **Echocardiography (cardiac failure indication)**



Standard surgical banding technique

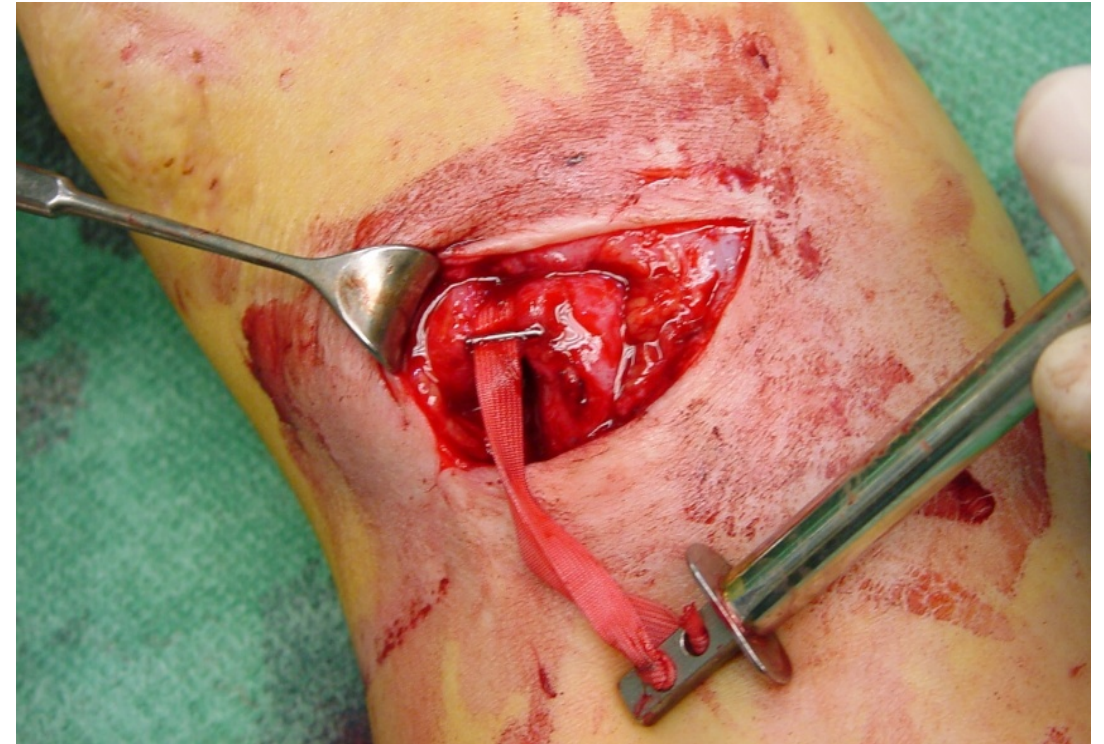
- *Locoregional anesthesia*
- *Intra-operative flow measurement*
- *Digital pressure measurement*





Standard surgical banding technique

- *5 mm mersilene suture*
- *Fixation with large clips*
- *Access flow 600-800 ml/min*
- *Digital pressure > 60 mm Hg*





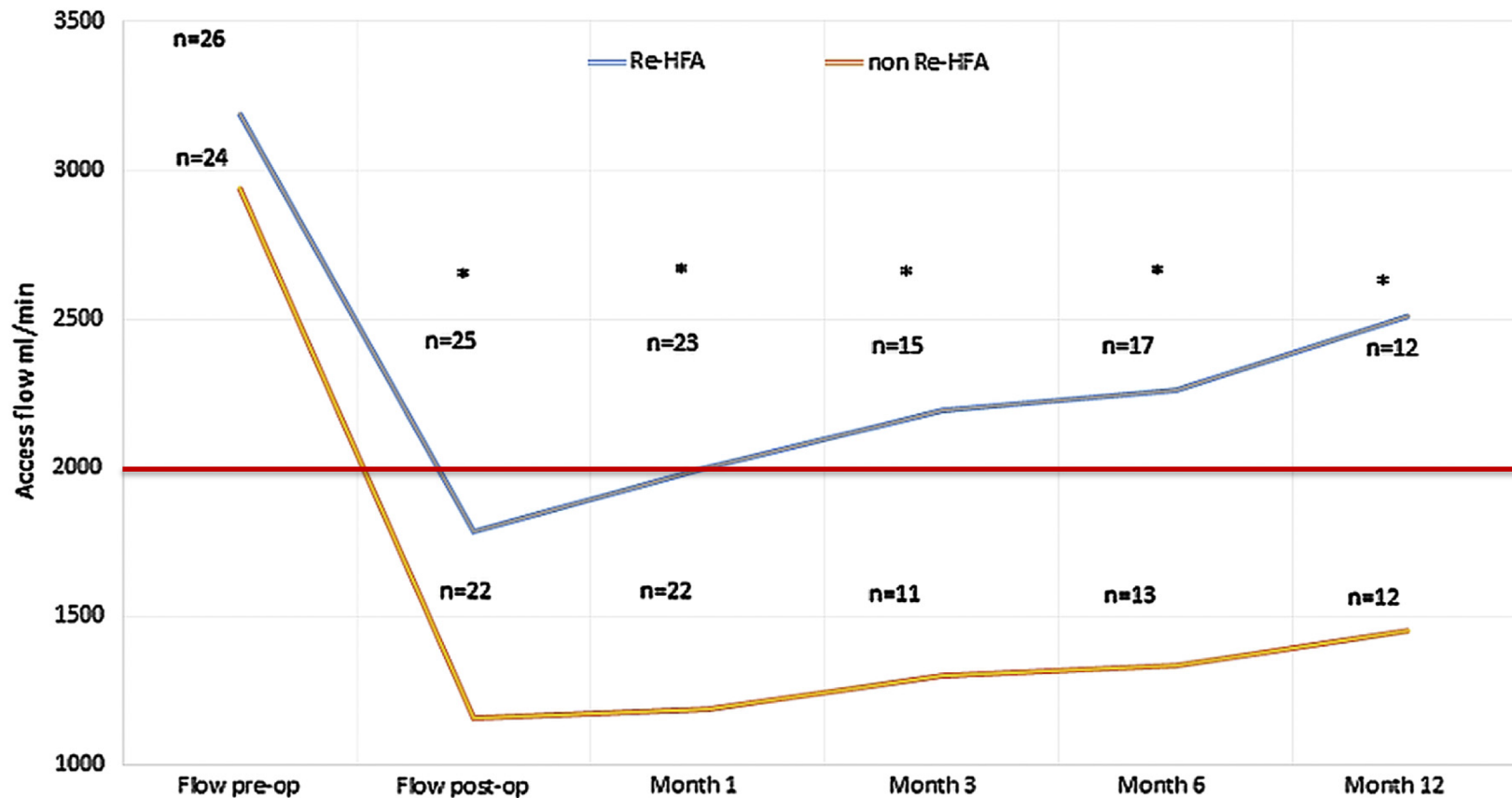
Flow reduction by surgical banding

Patient demographics (*N*=50)

Gender: male/ female	30/20
Mean age (years)	51 ± 2
Diabetes Mellitus (%)	3 (6)
PAOD (%)	6 (12)
Hypertension (%)	28 (56)
Time to banding (months)	30 ± 6
AVF (BCAVF/BBAVF/RCAVF)	28/20/2
Mean preop access flow (ml/min)	3070 ± 95



Long-term results surgical banding technique for HFA





Effectiveness of surgical banding

Author	Yr	Pt	100% success	50%	0%	Intraoperative Control tool	Occlusion <3 mo (n)	FU (mean, mo)
Tellis (11)	1979	1	0	0	1	blind	1	-
Wytrzes (16)	1987	2	0	2	0	blind	0	4
Dally (17)	1987	1	0	1	0	blind	0	8
Wahl (18)	1997	2	1	0	1	blind	0	-
Sessa (19)	2000	1	0	0	1	blind	1	-
Valentine (20)	2002	1	0	0	1	blind	1	-
Mwipatayi (21)								-
Nazzal (22)								-
Chia (23)								-
Seror (24)								-
Haimov (25)	1975	2	2	0	0	blind	0	12
Haimov (26)	1996	4	0	1	3	blind	3	-
Odland (14)	1991	16	10	6	0	PPG	6	6
Stierli (27)	1998	6	5	0	1	PPG	3	2
DeCaprio (4)	1997	11	10	0	1	PPG	9	-
Mattson (28)	1987	2	2	0	0	PPG	0	-
Subtotal I		55	33	10	12		26	

No intraoperative measurement!

60%

47%



Effectiveness of surgical banding

Author	Yr	Pt	100% success	50%	0%	Intraoperative Control tool	Occlusion <3 mo (n)	FU (mean, mo)
Zanow (29)	2006	78	67	11	1	Flow	3	25
DePalma (9)	1973	1	1	0	0	Flow	0	-
Kwun (30)	1979	2	2	0	0	Flow	0	-
Thermann (31)	2007	15	10	0	5	Flow	1	27
Meyer (32)	2002	7	7	0	0	Duplex	0	36
Jain (15)	1992	3	3	0	0	Duplex	0	-
Aschwanden (33)	2003	2	2	0	0	Duplex	0	-
Shemesh (34)	1999	3	3	0	0	Duplex	0	28
Schild (35)	2001	7	7	0	0	Pulsations	0	12
Stary (36)	2000	1	1	0	0	Pulsations	0	1
Montoya (37)	2000	1	1	0	0	Pulsations	0	1
West (38)	2000	1	1	0	0	Pulsations	0	1
Khalil (39)	2001	1	1	0	0	Pulsations	0	1
Papalois (40)	2001	1	1	0	0	Pulsations/symp	0	1
Ozisik (41)	2003	6	6	0	0	Puls/thrill/Duplex	0	6
Stanicia (42)	1997	1	1	0	0	Symptomatology	0	12
Goel (43)	2006	16	15	1	0	Sympt/Angio	0	3
Halevy (44)	1991	5	5	0	0	Pulse oximetry	0	-
Pomper (45)	2000	2	2	0	0	Pulse oximetry	0	17
Rivers (5)	1992	5	4	1	0	PVR	0	4
Ebeid (12)	1981	1	1	0	0	Doppler rad art	0	-
Porcellini (46)	1997	1	1	0	0	Doppler rad art	0	35
White (47)	1999	1	1	0	0	Doppler rad art	0	9
Subtotal II		171	152	13	6		4	

With intraoperative measurement!

89%

2%



Effectiveness of banding for HFA-associated cardiac failure

Author	Year	No. of patients	Age (mean, SD)	Access location	Months on dialysis	Flow pre-operative (mean, SD)	Flow post-operative (mean, SD)	Intra-operative 'flow tool'	Cardiac symptoms	Follow up (mo)	Complications
De Palma (78)	1973	1	60	Leg	NR	2.5	0.6	Yes	Improved	NR	-
Anderson(79)	1975	3	48	Wrist	36	2.1	0.6	Yes	Improved	8	-
Isoda (80)	1994	1	49	Wrist AVF	24	3.7	1.4	Yes	Improved	42	-
Tzanikis (81)	1999	1	48	Wrist AVF	NR	1.6	0.5	Blind	Improved	6	-
Murray (53)	2004	1	55	Elbow AVF	52	5.2	3.0	Yes	Improved	12	-
Bednarek (82)	2004	1		Elbow AVF	NR	4.0	0.9	NR	Improved	NR	-
Zanow (48)	2006	17	59 ± 3	Elbow + wrist AVF	72% > 12	2.1 ± 0.46	0.5 ± 0.7	Yes	96% Improved	6-37	12 % relapse/reoperation
Schneider (83)	2006	20	62 ± 3	Elbow + wrist AVF	NR	2.0 ± 0.5	± 0.2	Blind	95% Improved	1-3	20% occlusion/hematoma
Tellioglu (65)	2008	18	48 ± 9	Elbow AVF	NR	2.7	0.7	Yes	100% improved	12	-
Van Hoek (1)	2009	9	51 ± 8 (SEM)		87 ±	3.2 ± 0.3 (SEM)	1.2 ± 0.1 (SEM)	Yes	NR	30	11% relapse/reoperation

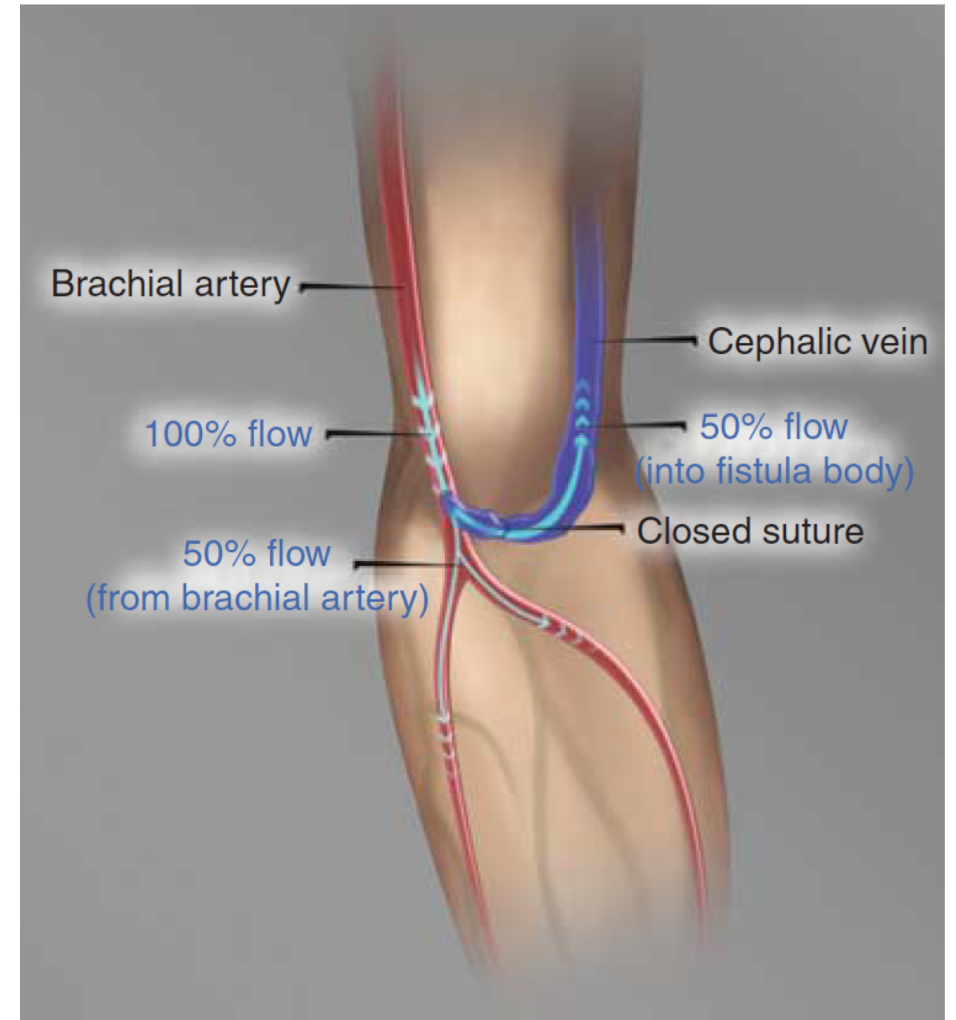
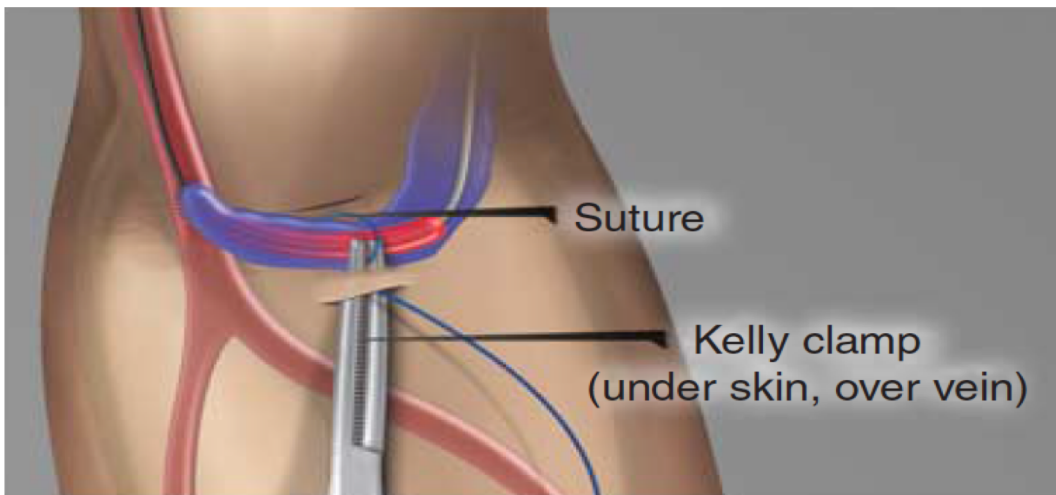
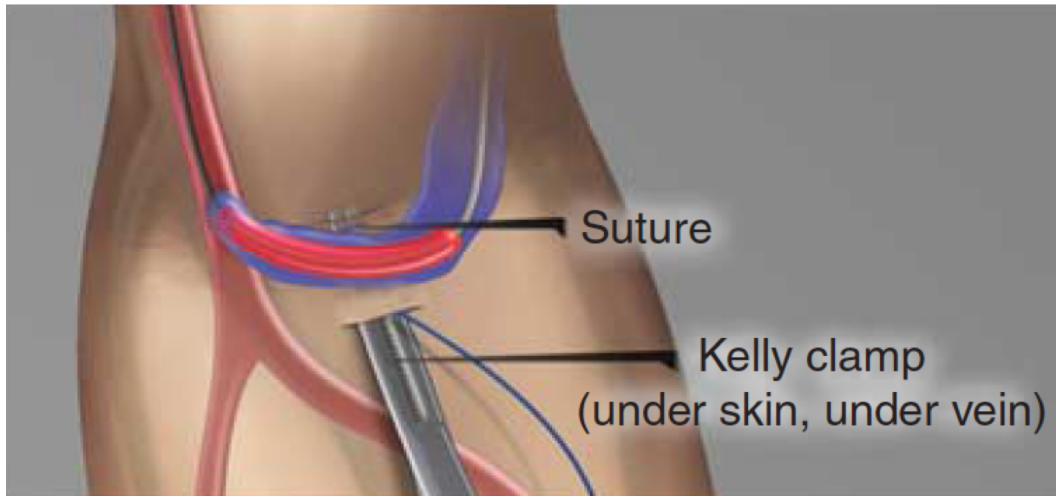
Total

72

95-100% improvement



Minimal invasive banding technique (MILLER)





Effectiveness of surgical banding

Summary studies for ischemia

Study (ref)	Number	Pre-operative classification	Technique	Symptomatic response (%)	Early thrombosis (%)
Wang 2016 (59)	30	Yes (SVS mean = 2.8)	Banding	79.1	4.1
Leake 2014 (53)	37	Yes	Banding	75	11
Wang 2013 (55)	7	No	Banding	100	0
Smith 2013 (54)	6	No	Banding	100	0
Gupta 2011 (46)	21	No	Banding	52.4	19
Shemesh 2010 (56)	7	No	Banding	100	0
Miller 2010 (52)	114	Non standard	Banding	88.6	4.4
Van Hoek 2009 (57)	9	Steal questionnaire	Banding	100	0
Thermann 2007 (58)	15	SVS classification I-III (75% mild steal)	Banding	66.7	0
Schneider 2006 (60)	6	No	Banding	83.3	0
Goel 2006 (61)	16	No	Banding	100	0
Morsy 1998 (62)	6	Yes	Banding	100	66.7
DeCaprio 1997 (63)	11	No	Banding	90.9	81.8



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Summary

- Major indication for banding is access-induced ischaemia
- Peroperative flowmeasurement \pm digital pressure measurement (HAIDI) are mandatory for an optimal result
- Locoregional anesthesia is indicated to establish stable peroperative bloodpressures
- Long-term outcome best with an initial low flow after operation
- 90-100% success rate in access-induced heartfailure patients
- Little information on the outcome of alternative banding techniques (MILLER)



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