



Percutaneous Peripheral Cannulation for Cardiopulmonary Bypass in MICS/Robotics

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COI Disclosure

The author have no financial conflicts of interest disclose concerning this presentation.



Groin Seroma after Surgical Femoral Cannulation

Complications Associated With Femoral Cannulation During Minimally Invasive Cardiac Surgery

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Background. Different types of cannulation techniques are available for minimally invasive cardiac surgery. At our institution, we favor a femoral platform for most minimally invasive cardiac procedures. Here, we review our results utilizing this cannulation approach.

Methods. We retrospectively reviewed all minimally invasive valve surgeries that were performed at our institution between January 2009 and January 2015. Operative times, lengths of stay, postoperative complications, and mortality were analyzed.

Results. We identified 2,645 consecutive patients. The mean age was 69.7 ± 12.77 years, and 1,412 patients (53.4%) were male. Three hundred fifty-eight patients (13.5%) had a history of cerebrovascular accident, 422 (16%) had previous heart surgery, and 276 (10.4%) had a history of peripheral vascular disease. The procedures performed were isolated aortic valve replacements (42.1%), isolated mitral valve operations (40.6%), tricuspid valve repairs (0.57%), double valve surgery (15%), triple valve surgery

(0.3%), and ascending aortic aneurysm resection with and without circulatory arrest (5%). Femoral cannulation and central cannulation were utilized in 2,400 patients (90.7%) and 244 patients (9.3%), respectively. The median aortic cross-clamp time and cardiopulmonary bypass time were 81 minutes (interquartile range, 65 to 105) and 113 minutes (interquartile range, 92 to 142), respectively. The median postoperative hospital length of stay was 6 days (interquartile range, 5 to 9). There were 31 cerebrovascular accidents (1.17%), no aortic dissections, two compartment syndromes, two femoral arterial pseudoaneurysms, and 174 (6.65%) groin wound seromas. The overall 30-day mortality was 57 patients (2.15%).

Conclusions. Minimally invasive cardiac surgical procedures utilizing femoral cannulation techniques have a low risk of complications.

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Table 5. Postoperative Outcomes

Outcome	Patients (n = 2,645)
Acute kidney injury	2.42 (64)
Reintubation	5.48 (145)
Deep wound infection	0 (0)
Bleeding requiring reoperation	2.38 (63)
Sepsis	1.51 (40)
Pneumonia	4.23 (112)
Aortic dissection	0 (0)
Femoral artery trauma ^a	0.07 (2)
Postoperative atrial fibrillation	18.30 (484)
Lower extremity compartment syndrome	0.08 (2)
Groin seroma/superficial infection	6.58 (174)
Intensive care unit readmission	3.25 (86)
Hospital length of stay, days	6 (5–9)
Thirty-day mortality	2.15 (57)



*Vascular
Closure
Device*



Percutaneous vs Surgical Femoral Cannulation

Percutaneous cannulation for cardiopulmonary bypass in minimally invasive surgery is associated with reduced groin complications

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Abstract

OBJECTIVES: Femoral cutdown is standard in most centres if groin cannulation is used for cardiopulmonary bypass in minimally invasive cardiac surgery (MICS). Arterial closure devices (ACDs) allow placement of larger cannulas percutaneously, but its benefit in MICS is unclear. We assessed our results with percutaneous groin cannulation using ACDs in comparison with conventional surgical access in patients undergoing MICS.

METHODS: We reviewed 445 consecutive patients having undergone MICS between October 2010 and March 2015. Of those, 92 (21%) were performed with conventional surgical access to the groin vessels and 353 (79%) with the use of ACDs.

RESULTS: Operative risk was higher in the ACD group [logistic EuroSCORE 7.9% (SD: 8.1) vs 10.6% (SD: 12.3); $P=0.010$]. The use of ACDs significantly reduced operation time [193 min (SD: 43.8) vs 173 min (SD: 47.1); $P<0.001$] and hospital stay [Cutdown: median 9 days (8, 14); ACD: median 9 days (7, 12), $P=0.040$] without affecting the time to full mobilization. The incidence of any complication was significantly lower in the ACD group (2.3% vs 8.7%; $P=0.007$). Complications with conventional cannulation consisted of lymphatic fistulae ($n=4$), wound infections ($n=2$), stenosis ($n=1$) and haematoma ($n=1$). In the ACD group, there were local dissections ($n=2$) and stenoses ($n=3$). There was 1 haematoma in both groups. There were 2 vascular injuries in the ACD group ($n=2$), leading to conversion to surgical access.

CONCLUSIONS: Percutaneous groin cannulation using ACDs for establishing cardiopulmonary bypass in minimally invasive valve surgery significantly reduces groin complications, operation time and hospital stay. However, the remaining complications are mainly of vascular nature versus wound infection and lymph fistulae with cutdown.

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Table 3: List of complications in all patients who underwent groin cannulation for CPB either by femoral cutdown (Cutdown) or percutaneously with the use of ACDs

	Cutdown (n = 92)	ACD (n = 353)
Lymphatic fistula	4	0
Acute bleeding	0	0
Access site infection	2	0
Haematoma	1	1
Femoral/iliac stenosis	1	3
Aneurysm/arteriovenous fistula	0	2
Vascular injury	0	2
Total	8 (8.7%)	8 (2.3%)

Data are presented as number of complications (%).

ACD: arterial closure device.



Nothing is Perfect?

Percutaneous Vascular Closure Device in Minimally Invasive Mitral Valve Surgery



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Background. Minimally invasive mitral valve surgery requires femoral artery cannulation for extracorporeal circulation, predominantly performed through surgical cutdown. Surgical groin incision is frequently associated with complications such as seroma and infection. We evaluated the safety and efficacy of a percutaneous plug-based large-bore vascular closure device (VCD) for femoral artery closure in minimally invasive mitral valve surgery.

Methods. This was a single-center prospective study comparing patients undergoing minimally invasive mitral valve surgery with femoral cannulation performed either through surgical cutdown or percutaneously with access site closure using a plug-based VCD (MANTA; Teleflex/Essential Medical, Malvern, PA).

Results. From 2016 to 2018, a total of 268 (147 surgical cutdown, 121 VCD) patients underwent minimally invasive mitral valve surgery with femoral arterial cannulation of catheters sized 19-F or 21-F. Propensity score

matching resulted in 109 matched pairs. In both the overall series and the propensity-matched cohort, VCD patients had a significantly higher incidence of Valve Academic Research Consortium-2 major access site vascular complications (overall cohort: 0% vs 4.1%; $P = .013$; propensity score-matched cohort: 0% vs 4.6%; $P = .024$). Bleeding did not occur in any group. In the overall series, surgical cutdown patients had a higher incidence of seroma (10.9% vs 0%; $P < .001$). Infection and seroma did not occur in the VCD group.

Conclusions. Percutaneous femoral artery cannulation using a novel plug-based VCD in minimally invasive mitral valve surgery eliminates traditional complications frequently seen with surgical cutdown with no femoral access site seroma and infection though at the expense of an increased risk for vascular complications.

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Table 2. Outcomes

Variable	Overall Cohort			Propensity Score-Matched Cohort		
	Surgical Cutdown (n = 147)	Vascular Closure Device (n = 121)	P Value	Surgical Cutdown (n = 109)	Vascular Closure Device (n = 109)	P Value
Femoral cannulation-related complications						
Major access site vascular complication (VARC-2)	0	5 (4.1)	.013	0	5 (4.6)	.024
Stenosis/intermittent claudication	0	3 (2.5)	.055	0	3 (2.8)	.081
Closure device embolization	...	2 (1.7)	2 (1.8)	...
Minor access site vascular complication (VARC-2)	3 (2.0)	0	.11	3 (2.8)	0	.081
Nerve injury	2 (1.4)	0	.20	2 (1.8)	0	.16
Seroma resulting in femoral vein obstruction	1 (0.7)	0	.36	1 (0.9)	0	.32
Access site seroma	16 (10.9)	0	<.001	9 (8.3)	0	.002
Access site infection	2 (1.4)	0	.20	1 (0.9)	0	.32
Any access site complication	20 (13.6)	5 (4.1)	.008	12 (11.0)	5 (4.6)	.077
Outpatient readmission for cannulation-related complication	8 (5.4)	3 (2.5)	.23	4 (3.7)	3 (2.8)	.72
Rehospitalization for cannulation-related complication	2 (1.4)	1 (0.8)	.69	1 (0.9)	1 (0.9)	.99
Intervention for cannulation-related complication	4 (2.7)	1 (0.8)	.26	2 (1.8)	1 (0.9)	.57
Other outcomes						
Postoperative stroke	0	4 (3.3)	.026	0	2 (1.8)	.16
New-onset temporary dialysis	2 (1.4)	2 (1.7)	.84	2 (1.8)	2 (1.8)	1.00
≥1 unit red blood cells transfused	26 (17.7)	26 (21.5)	.43	14 (12.8)	22 (20.2)	.14
ICU stay, d	1 (1-1)	1 (1-1)	.96	1 (1-1)	1 (1-1)	.11
In-hospital stay, d	4 (3-6)	4 (3-6)	.75	4 (3-6)	4 (3-6)	.65
30-day mortality	0	0	...	0	0	...



Percutaneous cannulation seems better?

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ORIGINAL ARTICLE

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Percutaneous versus surgical femoral access in minimally invasive cardiac operations

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Abstract

OBJECTIVES: Both surgical and percutaneous femoral accesses for the establishment of extracorporeal circulation are used in minimally invasive cardiac surgeries. The goal of this study was to compare the outcomes with the MANTA vascular closure device after percutaneous arterial decannulation via the surgical approach.

METHODS: Between November 2018 and January 2021, a total of 490 consecutive patients underwent minimally invasive cardiac operations at our institution. Cannulation and decannulation of femoral vessels were under direct vision surgically or percutaneously. The MANTA system was used to close the femoral artery in all patients with percutaneous cannulation. Demographic, clinical and procedural data were collected retrospectively.

RESULTS: Surgical cut-down and suture closure of the femoral artery was performed in 222 patients (45.3%); percutaneous access and closure with the MANTA system was used in 268 patients (54.7%). The surgical group presented a significantly higher incidence of any access site complication compared to the percutaneous group [18 patients (8.1%) vs 6 patients (2.2%); $P = 0.003$]. Lymph fistula and wound healing disorders occurred more frequently in the surgical group (3.2% vs 0% [$P = 0.004$] and 3.6% vs 0% [$P = 0.002$], respectively). Median procedural duration and stays in the intensive care unit were significantly lower in the percutaneous group {127 [interquartile range (IQR) 97–158] min vs 150 (IQR 117–185) min ($P < 0.001$) and 1 (IQR 1–2) day vs 2 (IQR 1–3) days ($P = 0.008$), respectively}.

CONCLUSIONS: Percutaneous access and closure with the MANTA system are feasible, safe and associated with lower incidences of all-cause access site complications and shorter stays in the intensive care unit compared to surgical access and closure in minimally invasive cardiac surgeries.

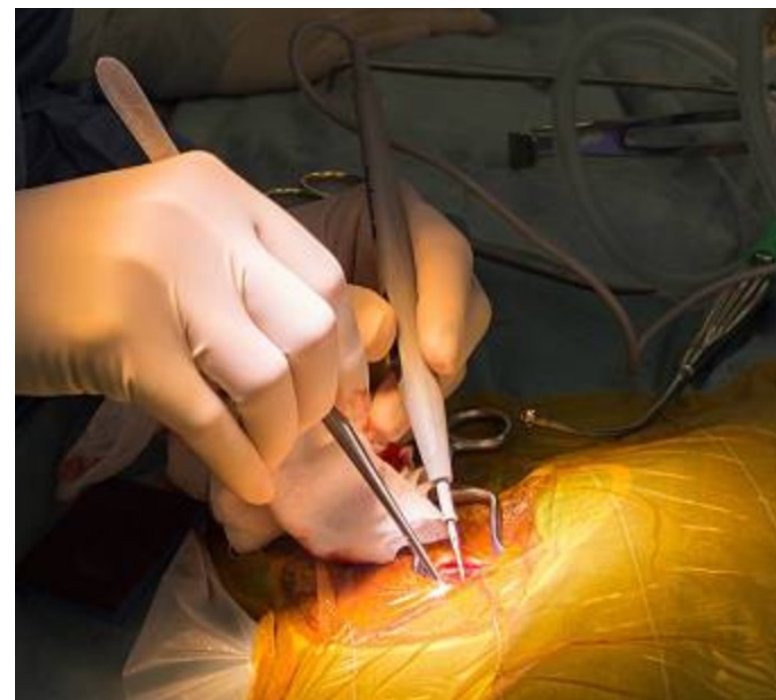
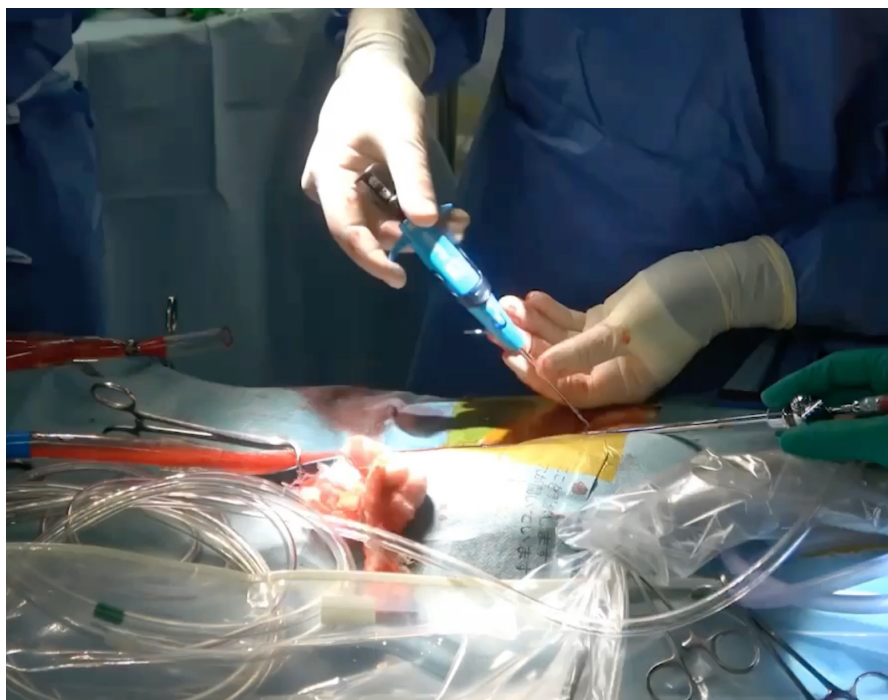
Table 4: Vascular complication-measured outcomes according to the Valve Academic Research Consortium criteria

	Cut-down (N = 222)	MANTA VCD (N = 268)	Total (N = 490)	P-value
Major vascular complications ^a	0 (0)	0 (0)	0 (0)	–
Minor vascular complications ^a	4 (1.8)	6 (2.2)	10 (2.0)	NS
Dissection	0 (0.0)	1 (0.4)	1 (0.2)	NS
Stenosis	0 (0)	0 (0)	0 (0)	–
Perforation	0 (0)	0 (0)	0 (0)	–
Rupture	0 (0)	0 (0)	0 (0)	–
AV fistula	0 (0)	0 (0)	0 (0)	–
Pseudo-aneurysm	0 (0)	3 (1.1)	3 (0.6)	NS
Haematoma	2 (0.9)	1 (0.4)	3 (0.6)	NS
Embolization	1 (0.5)	0 (0)	1 (0.2)	NS
Unplanned intervention	0 (0)	0 (0)	0 (0)	–
Need for vascular repair	2 (0.9)	4 (1.5)	6.0 (1.2)	NS
VCD failure	0 (0)	2 (0.7)	2 (0.4)	NS



Which is Better?

Percutaneous vs Surgical Femoral Cannulation





Percutaneous Cannulation in SCVC





Objective

- ✓ Evaluate safety and efficacy of percutaneous cannulation performed in SCVC.
- ✓ Find whether there is any other advantage of percutaneous cannulation.





Femoral Cannulation in MICS/Robotics

- ✓ Study period: Apr.2019 – Oct.2023
- ✓ MICS-AVR and Robotic MVR with femoral cannulation were performed for **300 cases** by single surgeon.
- ✓ They were divided into two groups, Cut down (Group C; n=123) and Percutaneous (Group P; n= 177).



Patient Data

<u>Variables</u>	Group C (n=123)	Group P (n=177)	P value
<u>Age, years (range)</u>	65 (20-94)	67 (22-89)	NS
<u>Operation</u>			
MICS-AVR, n (%)	62 (50)	56 (32)	0.002
Robotic MVR, n(%)	48 (39)	89 (50)	0.003
with TVr and/or MAZE, n(%)	13 (11)	32 (18)	0.002

Tools for Percutaneous Cannulation

The tip shape for not entering the side branch.



Swan Excell GW 0.035Fr, 150cm



First Suture

Second Suture

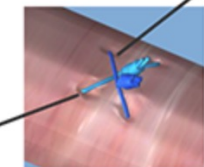
Rotate $\sim 30^\circ$
to patient's
right side

Rotate $\sim 30^\circ$
to patient's
left side



First Suture

Second Suture



Cannulas for Percutaneous Cannulation

Artery



Bio-Medicus® NextGen Medtronic

BSA	<1.6m ²	1.6-2.0m ²	>2.0m ²
Size	15Fr	17Fr	19Fr

Vein

GETINGE ✱



BSA	<1.6m ²	1.6-1.8m ²	>1.8m ²
Size	21Fr	23Fr	25Fr



Operative Data

Variables	Group C (n=123)	Group P (n=177)	P value
<u>Time, mean min (range)</u>			
Operative time	208 (127-340)	187 (120-310)	<0.001
Cardio-pulmonary Bypass time	135 (64-250)	125 (71-257)	0.016
Aortic Cross Clamp time	95 (36-199)	80 (31-180)	<0.001
<u>Complications, n (%)</u>			
Groin Seroma	7 (5.7)	0 (0)	0.002
Any Peripheral Vascular Complication	1 (0.8)	0 (0)	NS
Aortic Dissection	0 (0)	0 (0)	NS
Acute kidney injury	3 (2.4)	4 (2.2)	NS
Stroke	1 (0.8)	0 (0)	NS

Post-operative Data

<u>Variables</u>	Group C (n=123)	Group P (n=177)	P value
<u>Postoperative Laboratory Data, mean</u>			
Peak CPK, U/L	1910	1137	<0.001
Peak Creatinine, mg/dL	1.4	1.5	NS
Peak AST/ALT, U/L	75 / 43	65 / 40	NS/NS
<u>Postoperative course</u>			
ICU stay, d	1.5 (1-6)	1.2 (0-5)	<0.001
in-hospital stay, d	6 (3-37)	5.3 (3-10)	NS
30-day mortality, n (%)	1 (0.8)	0 (0)	NS
<u>Re-hospitalization, n (%)</u>			
for cannulation related complication	6 (4.9)	0 (0)	<0.001



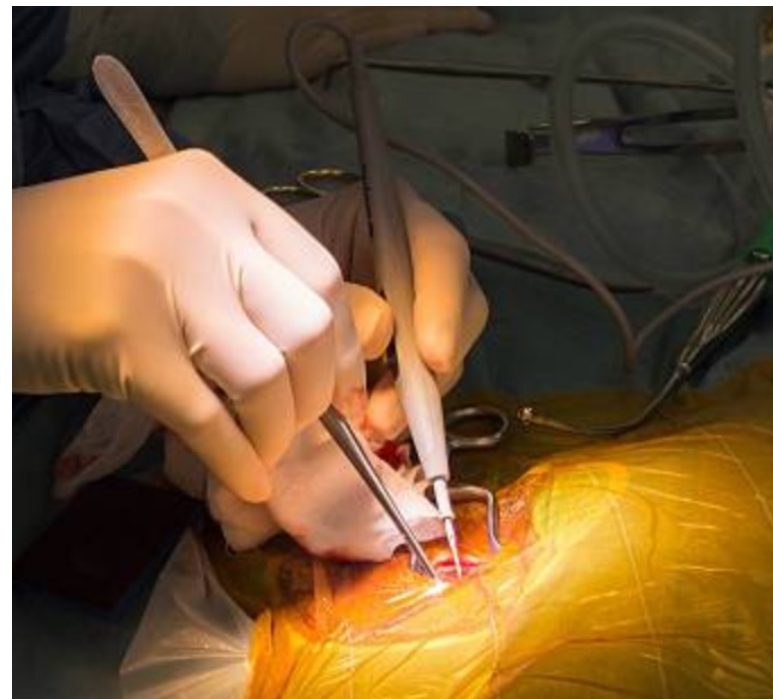
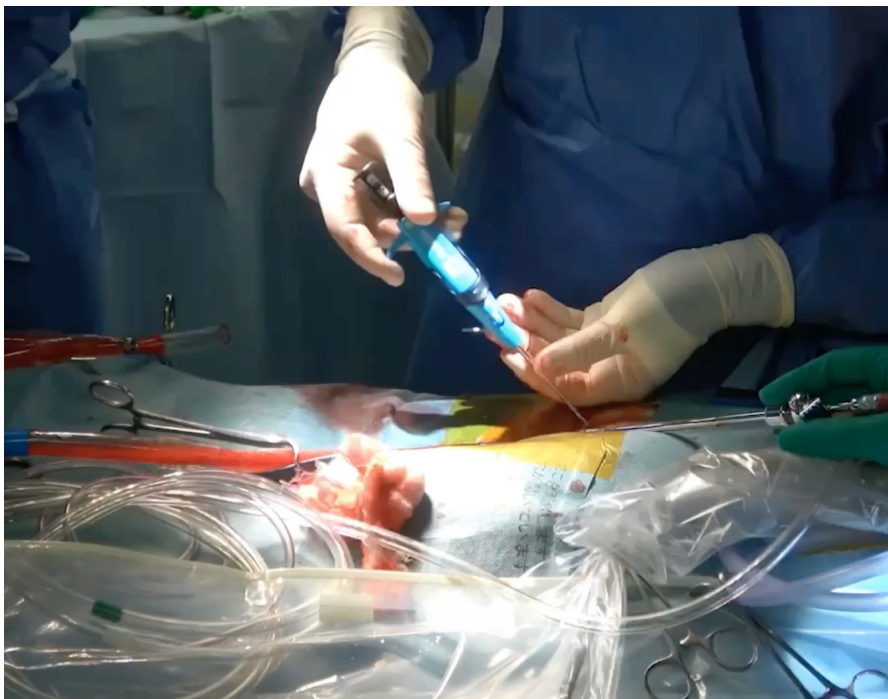
Conclusion

Percutaneous cannulation

- Can be safely performed with experienced team.
- Reduces groin trouble without increasing vascular complication.
- It possibly has advantages in maintaining peripheral blood flow during the surgery.

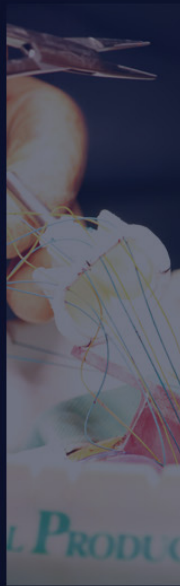
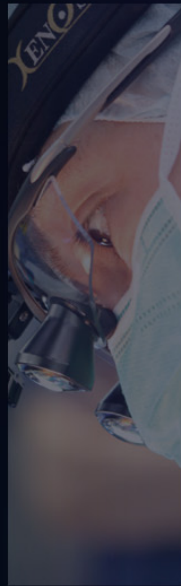
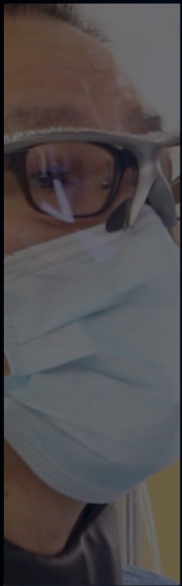


Which would you like to choose?





医療法人 札幌ハートセンター
札幌心臓血管クリニック
<https://scvc.jp>



Thank you !

Makoto Hashimoto

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