The 11th Japan-Korea Joint Meeting for Vascular Surgery

Venue: Hotel Nagoya Castle, Nagoya, Japan
Date: May 23 (Thu.), 2019
President: Kimihiro Komori

Symposium "Clinical research from Japan and Korea"

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Division of Vascular Surgery, Department of Surgery, Nagoya University Graduate School of Medicine, Nagoya, Japan

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Department of Surgery, Vascular and Endovascular Division, Research Institute for Convergence of Biomedical Science and Technology, Pusan National University Yangsan Hospital, Yangsan, Korea

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Yutaro Aoyagi
Department of Cardiovascular Surgery, Keio University School of Medicine, Tokyo, Japan

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Free Paper (Oral) 1

Moderators:
Hiroyuki Ishibashi
Aichi Medical University
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O1-1

Novel Surgical Experimental Model of Enlarging Abdominal Aortic Aneurysm in Rats

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Objective
Few small-animal models exist for the study of abdominal aortic aneurysm (AAA). This study tested the hypothesis that an experimental model of abdominal aortic aneurysm in rats results in progressive enlargement when performed intraoperative trauma in aortic wall.

Methods
Twenty rats were randomly divided into 2 groups: postoperative 6 weeks (A) postoperative 9 weeks (B). Under the anesthesia, after entering the abdomen via a midline incision. The aorta is dissected free the IVC in this vicinity. The lumbar vessel are ligated. The clamped aorta cut and puncture 6 point by 7-0 cutting suture needle. Sutured aorta by Open–loop technique using Nylon 9-0. The aortic diameter was measured after Intra-operation and 6 and 9 weeks, and animals were subsequently euthanized for histopathologic studies.

Results
Two animals in the aneurysm group developed aneurysm: group A: 60%, group B: 80%. Initial diameter is 1.3 ±0.14 mm. In Group A and 1.2 ±0.11 mm in Group B, after operation, with average diameters of 3.8 ±2.62 mm by group A, 3.0 ±1.32 mm by group B, respectively. Similar to human AAAs, mural thrombus with vascular smooth muscle cell apoptosis was observed in all AAAs. The aneurysm group exhibited less media thickness, elastin content, and endothelial recovery, Qualitatively, increased macrophages were noted at the wall-mural thrombus interface, and increased neutrophils were noted in the mural thrombus. Huge AAA (>3.5 mm) tissue demonstrated significantly increased numbers of neutrophils and macrophages compared with AAA (>2.5 mm, <3.5 mm).

Conclusions
This surgical rat AAA model with a gradually enlarging diameter is simply and reliably induced, appropriately mimicking human aortic aneurysm disease.

O1-2

Risk Stratification of Open Surgery for Abdominal Aortic Aneurysm

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Background
Endovascular aneurysm repair has become a predominant alternative for abdominal aortic aneurysm (AAA) all over the world. There is a new problem that young vascular surgeons don’t have enough opportunities for open surgery training, although open surgery remains an indispensable way of treatment.

Objective
The objective of the present study is to analyze the anatomical factors that can make open surgery complex in order to enhance an efficient surgical training.

Methods
We included consecutive patients who underwent OS for AAA or iliac artery aneurysms, excluding solitary iliac and ruptured aneurysms. Six factors of complexity (supra-renal aortic clamp, dissecting aneurysms, infectious/inflammatory aneurysms, branch reconstruction, redo surgery for aorta and miscellaneous [horse shoe kidney, disseminated intravascular coagulation]) were selected. Operations with complex factors were compared to operations without complex factors with respect to surgical outcomes.

Results
A total of 736 cases were included, and 149 cases (20.2%) were complex surgery. Numbers of each factor of complexity were as follows: supra-renal aortic clamp, 26 cases (3.5%); dissection, 8 cases (1.1%); infection/inflammation, 75 cases (10.1%); branch reconstruction, 34 cases (4.6%); redo surgery, 10 cases (1.4%); miscellaneous, 9 cases (1.2%). The proportion of complex surgery kept on increasing every five year (15%, 18%, 23% and 27%; p = 0.03). In complex surgeries, operation time (256 ± 71 min vs. 208 ± 51 min, p < 0.0001), estimated blood loss (681 ± 501 mL vs. 412 ± 257 mL, p < 0.0001), transfusion (13% vs. 4.1%, p < 0.0001), severe complications defined as Clavien–Dindo class 3–5 (13% vs. 6.0%, p = 0.002) and
in-hospital death (4.0% vs. 0.7%, p = 0.006) were significantly poorer. In subanalysis, supra-renal aortic clamp (302 ± 75 min vs. 215 ± 56 min, p < 0.0001), redo surgery (300 ± 82 min vs. 217 ± 58 min, p < 0.0001) and miscellaneous (287 ± 73 min vs. 217 ± 58 min, p = 0.0004) were associated with longer operation time compared to the control group by more than 60 min. Similarly, miscellaneous (1180 ± 596 mL vs. 458 ± 326 mL, p < 0.0001), redo surgery (1125 ± 810 mL vs. 458 ± 320 mL, p < 0.0001) and supra-renal aortic clamp (751 ± 389 mL vs. 456 ± 333 mL, p < 0.0001) increased estimated blood loss by more than 1.5 times. Moreover, severe complications were observed significantly more frequently after miscellaneous (56% vs. 6.9%, p = 0.0002) and redo surgery (30% vs. 7.2%, p = 0.03). In-hospital death were significantly higher after miscellaneous (22% vs. 1.1%, p = 0.006). Considering these results, we stratified the risk of operation into 3 stages: High risk, supra-renal aortic clamp, redo surgery for aorta, miscellaneous; Intermediate risk, aortic dissection, infection or inflammation, branch reconstruction; Low risk, without above-mentioned factors. When we stratified the overall cohort, backgrounds were not significantly different between 3 different risk groups other than hypertension. However, perioperative outcomes including operation time, estimated blood loss, incidences of complications and in-hospital death as well as hospitalization length and costs significantly increased in a step-wise manner according to the risk stratification.

Conclusions

AAAs without above-mentioned complex factors can be operated at low risk, thus are suitable for surgical training at an early stage. Dissecting aneurysms, infection and inflammation, and branch reconstruction come the next with intermediate risk. On the other hand, horse shoe kidney, disseminated intravascular coagulation, supra-renal aortic clamp and redo surgery for aorta carries high risk at operation.

Clinical Utility of Serum Biochemical Markers as a Predictor of Ischemic Colitis after Open Abdominal Aortic Aneurysm Repair

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Purpose

Ischemic colitis (IC) is a severe complication following abdominal aortic aneurysm (AAA) repair, which affects morbidity and mortality. However, the diagnosis mostly depends on clinical symptoms, such as pain, hematochezia, or signs of progressing sepsis. Moreover, some patients exhibit subclinical course in relation to the degree of bowel ischemia. Flexible sigmoidoscopy might be a confirmatory test, but still a physician’s impression based on clinical presentations should be proceeded to employ a proper diagnostic measure; thus it is not risk effective as a screening test regarding timing of treatment.

The purpose of this study was to evaluate utility of serum biochemical markers as a predictor of IC in patients who underwent open abdominal aortic aneurysm repair.

Method

From July 1995 to February 2019, a total of 935 patients underwent open AAA repair at Samsung Medical Center. We retrieved the following data of those patients from the electronic medical record: demographic information, medical history, operative details, use of inotropic agents, and level of serum biochemical markers including lactate, creatinine kinase (CK), lactate dehydrogenase (LD), the white blood cell (WBC) count, potassium (K), alanine transferase (ALT), aspartate transferase (AST), C-reactive protein (CRP), myoglobin, procalcitonin (PCT) on postoperative day (POD) 0, 1, 2, and 3. Patients were divided into two groups, those experienced IC or the others did not. Two groups were compared for each variable, and a receiver operating characteristic (ROC) curve was generated to determine the predictive value of each biochemical marker.

Results

Of 935 patients, IC occurred in 2.6% of patients (n = 22). In the IC group, the median time to detect the initial signs and symptoms was 2 days (range 1–7), and to operation was 2 days (range 1–11). The IC group showed higher median value of lactate, LD, and CK on the POD2 and 3 than no IC group (p ≤ 0.001). For the other biochemical markers, K was elevated higher on POD 0 and 1, AST and ALT were elevated higher on POD 1, 2, and 3, and CRP was only measured higher on POD 2, and 3. Patients were divided into two groups, those experienced IC or the others did not. Two groups were compared for each variable, and a receiver operating characteristic (ROC) curve was generated to determine the predictive value of each biochemical marker.

Since shock physiology of ruptured AAA might affect elevation of those biochemical markers, we divided the patients into intact AAA (n = 741) and ruptured AAA (n = 94), and each group again subdivided into IC group and no IC group. In the intact AAA group, the incidence of IC was 1.8% (n = 13), but 9.6% (n = 9) in the patients of ruptured AAA. The IC group of intact AAA showed higher level of lactate, LD, AST, ALT on POD 2 and 3 than the no IC group of intact AAA with statistical significance.

Based on the ROC curve of total 935 patients, area under curve (AUC) > 0.7 (p < 0.001) were found in lactate, CK, LD, AST, ALT, and K. The intact AAA group showed AUC > 0.7
Conclusion
Although serum biochemical markers can be interfered by many other patients' conditions, serum levels of lactate, CK, LD, AST, ALT, and K within 3 days of postoperative period are possible predictors to rule out IC in patients after open AAA repair, especially in those with intact AAA. In case of ruptured AAA, changes in the biochemical markers were unlikely to be specific only for colonic ischemia, but probably affected by multiorgan dysfunction.

Outcome of Surgeon-modified Fenestrated Stent-Grafts for Complex Juxta-Renal Aortic Pathologies

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Purpose
To analyze the outcome of surgeon-modified fenestrated and branched stent-grafts (sm-FBSG) in high-risk AAA patients with complex juxta-renal aortic pathology.

Methods
A single-operator (two institutions located in an ordinance-designated city) retrospective analysis was conducted of 30 consecutive patients (mean age 75 years, range 61–89; 3 women) from June 2011 to January 2019. The indications included 27 juxtarenal AAA, 2 Type I Endoleak, 1 juxta-renal AAA complicated by Type B dissection, and 1 impending rupture of infectious TAAA after EVAR. The mean aneurysm diameter was 57.9 ± 10.5 mm.

Results
No intraoperative myocardial infarction, stroke, or bowel ischemia occurred in this cohort. Seventy-four (1 to 4, mean 3) renovisceral branches were targeted. The perfusion could be maintained except one renal artery originated distally to severely angulated aortic neck. One renal artery occluded due to the dissection in a perioperative period. Mean follow-up was 400 days (range 28–1657). Follow-up imaging studies showed the patency of other targeted branches, remnant of minor endoleaks (4 type II, 1 type III), and no diameter growth of the degenerative aneurysms. The mean length of in-hospital stay was 9 days (range 4–78). There was no death within 30 days. One patient suffered compartment syndrome that needed fasciotomy. One late aneurysmal (infectious TAAA) and one other aneurysm-related (arch aneurysm) death occurred. Postoperative 4-year survival was 39.8%.

Use of Physician-modified Endografts to Overcome Hostile Anatomies not Amenable for Routine EVAR in The Treatment of Abdominal Aortic Aneurysms

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Purpose
Physician-modified endografts (PMEG) can be an alternative for treatment of hostile abdominal aortic aneurysms (AAA) that are outside the instructions for use (IFU) for standard endovascular aneurysm repair (EVAR). In this study we analyzed our early outcomes of PMEGs for treatment of complex AAAs.

Methods
From Jan. 2016 to Feb. 2019, a total of 18 EVARs were performed using PMEGs at a single institution. The indications for use of PMEGs were preservation of visceral/renal flow in 11 cases and preservation of pelvic circulation in 7 cases. Fenestrations and/or scallops were created on commercial stent grafts (Cook Zenith) by use of ophthalmic electrocautery, and radiopaque rings from snares were placed around the fenestrations using polypropylene sutures. Branches were created in a similar way to commercially available iliac branched devices (IBD) by using a self-expanding covered stents cut in a beveled fashion and anastomosed to the stent grafts. Self-expanding covered stents were used to bridge the fenestrations and branches. Meticulous preoperative planning was performed using 3 dimensional reconstruction software programs.

Results
The mean age was 74.3 ± 8.6 years and 94% were male patients. Patients were mostly high-risked with a median ASA
Abdominal Aortic Aneurysm Rupture in a Patient with Type II Endoleak after Endovascular Aneurysm Repair

Yutaro Aoyagi, Yuijiro Kawai, Tsutomu Ito, Masatake Yamazaki, Naritaka Kimura, Tatsu Takahashi, Syo Akiyama, Yuta Akamatsu, Hidetoshi Oka, Tomohiko Nakagawa, Shintaro Nakajima, Satoru Murata, Hideyuki Shimizu

Introduction

An endoleak is one of the major problems after endovascular aneurysm repair (EVAR) for an abdominal aortic aneurysm (AAA). Type II endoleaks from lumbar arteries (LAs) and/or inferior mesenteric arteries (IMAs) are observed in about 10% of patients after undergoing EVAR, and they remain for a long time after the procedure. Some treatments, such as transcatheter intervention and artery ligation, have been reported, but there are still too many patients with type II endoleaks to treat. In our institution, interventions for LAs or IMAs regarding Type II endoleaks are performed on patients with sac expansion.

Case

A 79-year-old man with Parkinson's disease was treated with EVAR for AAA using Medtronic ENDURANT II stent graft system two years ago. The procedure was performed successfully without any type I or III endoleaks. An enhanced computed tomography (CT) scan, which was taken a week after the operation, revealed a type II endoleak from LAs and an IMA. He was treated in our clinic once every three months after discharge from our hospital and CT scans were performed 1, 6 and 12 months after the procedure. In each scan, a type II endoleak still remained, but the enhanced area of the sac was reduced and there was no sac expansion. Twenty-one months after the operation, he was admitted to another hospital to be treated for deep venous thrombus and pulmonary artery embolism. Anticoagulation therapy with direct oral anticoagulant began. Three months after the admission, he came to our clinic for a regular check-up without any symptoms. In laboratory testing, hemoglobin was reduced to 7.4 g/dl from 10.4 g/dl. A whole body CT scan was performed to search for the origin of anemia and revealed an AAA rupture. An urgent operation was performed and the AAA was replaced with a graft. During operation, there was a hematoma in the retroperitoneum. The aorta was clamped between renal arteries and the superior mesenteric artery. When the sac was opened, there was blood flow from the lumbar arteries so they were ligated to stop the bleeding. There was also blood flow from the right common iliac artery outside of the stent-graft, which suggested that there was a type Ib endoleak. The stent-graft was removed and a graft-replacement was performed. The postoperative course was uneventful, but he required additional rehabilitation because of his Parkinson's disease, so he was transferred to another hospital.

Discussion

Type Ib endoleaks have a higher risk of AAA ruptures than type II endoleaks after undergoing EVAR. In this case, a type II endoleak was detected from the CT scan after EVAR, but there was no enlargement in the maximum short axis diameter of the AAA. Lumbar arteries, which caused the type II endoleak, were a nearby bifurcation of the aorta. It might cause dilatation of the terminal portion of the aorta and the right iliac artery, which could lead to a type Ib endoleak. The type II endoleak itself could cause AAA rupture, but we think that attention should be paid to both the maximum short axis diameter and the landing zones to ensure that they are long enough to avoid a type I endoleak.

He had no symptoms and had stable vital signs when he came to our clinic, even though he had severe anemia. It might be because the AAA rupture had occurred slowly, and the severity of the endoleaks was too small to be life-threatening.

Conclusions

We have to check not only the maximum short axis diameter...
but also the proximal and distal landing zones to prevent type I endoleaks and AAA rupture.

**O1-7**

**PETTICOAT-Kanjiki Method for Prevention of d-SINE During TEVAR**

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¹Department of Vascular Surgery, Aichi Medical University, Aichi, Japan, ²Department of Radiology, Aichi Medical University, Aichi, Japan

**Introduction**

Distal stent graft-induced new entry (d-SINE) would occur during thoracic endovascular aortic repair (TEVAR) for type B aortic dissection (TBAD). Simple placement of Zenith Dissection Endovascular Stent (TXD, PETTICOAT-method) is not effective for it. Recently, we add TXD from a proximal stent graft and deploy a distal stent graft within the TXD for prevention of d-SINE (PETTICOAT-Kanjiki method).

**Results**

Since 2014, 72 consecutive acute TBAD patients (53 male, average age 67 ± 13 y.o.) were treated at our hospital. Among them, 16 patients (22%) underwent TEVAR during acute and subacute phase. One patient developed d-SINE. This patient was complexed with right lower limb malperfusion and CTAG was placed at Zone 2. The true lumen remained narrowed, so TXD was added to just above the celiac artery and a stent was added in the narrow right iliac artery. However, the true lumen did not gain expansion and follow-up CTA revealed d-SINE at a distal edge of the CTAG and the iliac stenosis was deteriorated. By adding a second CTAG inside the TXD, the true lumen of aorta and also the iliac artery regained immediately. Based on this case, we started deployment of distal stent graft within the TXD for prevention of d-SINE (PETTICOAT-Kanjiki method).

**Conclusions**

Simple use of bare stent is not effective for prevention of d-SINE. Placing second stent graft within TXD may be effective to prevent d-SINE. It seems to be also effective for chronic dissection with a narrow true lumen.

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**O1-8**

**Mid-term Behavior of Frozen Elephant Trunk with Total Arch Replacement**

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Department of Cardiovascular Surgery, Tokyo Medical University, Tokyo, Japan

**Background**

After total aortic arch replacement (TAR) with a frozen elephant trunk (FET) procedure, an additional thoracic endovascular aortic repair (TEVAR) is sometimes required for potentially-occurred sequelae such as type1b endoleak (EL) and aortic rupture. The aim of this study is to determine the behavior of FET distal edge in the postoperative surveillance.

**Methods**

Between April 2015 and December 2017, a total of 42 patients (mean age: 70.1 ± 9.7 years old, M 38 : F 4) underwent TAR with FET. Aortic pathologies were non-dissecting thoracic aortic aneurysm (TAA) in 22, aortic dissection (AD) in 19 (acute 9, chronic 10) and Takayasu arteritis in 1. As FETs, FROZNIX (Japan Life Line, Tokyo, Japan) devices were used in all cases. The preoperative JAPAN/EURO Scores for TAR with FET were 10.7 ± 11.7/4.3 ± 3.6. The postoperative surveillance was carried out for 14.0 ± 9.8 months. The postoperative CT-scans were analyzed to determine the position of FET distal edge, the angle of the FET distal edge and the subsequently occurred bird-beak between the FET distal edge and the lesser curvature of descending aorta. For 7 patients (16.7%), additional TEVARs were performed; elective in 6 and emergency due to rupture in 1. There were no paraplegia and no complications in the additional TEVAR. In the additional TEVAR group, the positions and angles were the level of Th 5.6 ± 0.5 and 48.3 ± 22.4 degrees, whereas and bird-beaks were detected in 5 patients.
Conclusions
The shallower positions and steep angles of the FET distal edge due to shorter-length FETs caused bird-beaks of the FET distal edge. Additional TEVAR with delay is a good option for such potentially-lethal sequelae.

Free Paper (Oral) 2

Moderators:
Jun-o Deguchi
Saitama Medical University
Sang Su Lee
Pusan National University Yangsan Hospital

O2-1
Risk Factors for Development of Perioperative Stroke after CEA

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Objective
Stroke is one of the most dreaded complications of carotid surgery. Aim of this study is to determine risk factors for the development of perioperative stroke in patients who underwent carotid endarterectomy (CEA).

Method
We conducted a retrospective analysis using database of CEA patients at a single institution. All consecutive patients who underwent CEA during the past 23 years were included for the analysis excluding patients who underwent combined CEA and coronary artery bypass grafting. Perioperative stroke was defined as a new onset neurologic deficit of any cause within 30 days after CEA which lasted for ≥24 h with an evidence of stroke on imaging study. Risk factor analysis was conducted using uni- and multivariable analyses testing variables of demographic (age, gender), clinical (symptomatic < 6 mo versus asymptomatic versus past history [> 6 mo] of stroke; ocular versus TIA versus minor stroke) and anatomic

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Perioperative (≤ 30 days after CEA) stroke after CEAs</th>
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<tr>
<td></td>
<td>Ischemic stroke (n = 12, 1%)</td>
</tr>
<tr>
<td>Ipsilateral vs. Non-ipsilateral stroke</td>
<td>83.3% vs. 16.7%</td>
</tr>
<tr>
<td>Minor vs. major* stroke</td>
<td>75% vs. 25%</td>
</tr>
<tr>
<td>Intraoperative vs. ≤ 2 d vs. 3–30 d</td>
<td>25% vs. 16.7% vs. 58.3%</td>
</tr>
</tbody>
</table>

*Major stroke was defined as stroke with NIHSS ≥ 9 or modified Rankin scale ≥ 3.
(contralateral carotid occlusion, previous cervical irradiation), procedural (timing of CEA after symptom onset; primary closure versus patch closure) variables, postoperative medication (statin use versus no statin use; single versus dual antiplatelet therapy) and co-existing disease (hypertension, diabetes mellitus, ischemic heart disease, hyperlipidemia, smoking, atrial fibrillation, chronic kidney disease). For statistical analyses, we used simple and multiple logistic regression. And we separately analyzed the risk factors for any-cause, ischemic, and hemorrhagic strokes.

Results
After excluding 48 combined CEA and CABG, 1,153 CEAs for 1,051 patients (male, 86.6%; mean age, 68.1 ± 7.8 years; symptomatic 34.3%) were included for the analysis. Among them, 15 (1.3%) strokes developed within 30 days after CEAs. Among them, major stroke developed in 0.26% of CEA patients. Causes, onset and severity of the strokes were shown in Table 1. Results of the risk factor analyses were demonstrated in Table 2.

Conclusion
For patients undergoing CEA, perioperative stroke was uncommon and majority of them was ipsilateral, ischemic and minor stroke. As a predictor of perioperative stroke, symptomatic patient particularly presenting with minor stroke was an independent risk factor for the development of new perioperative stroke after CEA.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Risk factor analyses for perioperative stroke according to the type of the stroke</th>
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<tbody>
<tr>
<td></td>
<td>Risk factor</td>
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<tr>
<td>Any stroke (n = 15)</td>
<td>Symptomatic (&lt;6 mo)</td>
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<tr>
<td></td>
<td>Minor stroke</td>
</tr>
<tr>
<td>Ischemic stroke (n = 12)</td>
<td>Symptomatic (&lt;6 mo)</td>
</tr>
<tr>
<td></td>
<td>Minor stroke</td>
</tr>
<tr>
<td>Hemorrhagic stroke (n = 3)</td>
<td>Unidentified</td>
</tr>
</tbody>
</table>

*Simple logistic regression, **Multiple logistic regression

Natural history of Spontaneous Isolated Celiac Artery Dissection after Conservative Treatment
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Objective
Spontaneous isolated celiac artery dissection (SICAD) is rare disease and it’s natural history is not well understood. We try to determine natural history of SICAD after conservative treatment.

Methods
We retrospectively reviewed a database of consecutive patients with SICAD in a single center from December 2002 through October 2018. SICAD was defined as nonatherosclerotic, nonaortic dissection and diagnosis of SICAD was made with contrast-enhanced CT scans. Demographics, clinical features, morphologic characteristics on computed tomography, treatment modalities, and follow-up results of these patients were retrospectively reviewed.

Results
During the past 16 years, 51 SICAD patients (male, 86.3%; mean age, 52.5 ± 10 years; symptomatic, 78.4%) were enrolled. None of these patients had unstable complications on admission, and all underwent initial conservative treatment. Clinical features and morphologic change with CT examinations were available in 92.2% and 90.2% respectively during
the follow-up period of mean 30.8±34.4 months (1–189
months). Of 40 symptomatic patients treated with conserva-
tive treatment, 87.5% of patients showed pain resolution and
12.5% of patients developed recurrent abdominal pain. On
follow-up examinations (n = 46) of the CT angiography, there
showed "no change" in 38.1%, partial or complete "remodel-
ing" in 40.9%, aneurysmal change in 2.2%, and progression
of the dissection in 6.5%. However, there was no rupture of
SICAD during the follow-up period. When we analyzed the
follow-up results of clinical features and morphologic change
by the angiographic types, symptomatic patients were more
common in type Ia patients. Patients with intramural hema-
toma on initial images showed dynamic vascular remodeling
(partial to complete resorption) during the follow-up period
compared with patients who had dominant intimal flap on
initial images.

Conclusion
With conservative treatment, majority of SICAD patients
showed clinical improvement and morphologically no change
or remodeling on the long-term follow-up observation. We
recommend conservative treatment for all patients with
SICAD as the first-line treatment regardless of angiographic
types but further evaluation with long-term follow-up in a
large population is needed.

Safety and Effectiveness of Incomplete Revascular-
ization for Critical Limb Ischemia in Patients with
Peripheral Arterial Disease
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Introduction
One-year mortality of up to 25% has been reported in
patients with critical limb ischemia (CLI) and 30% of CLI
patients lose their legs within 1 year. However, surgical re-
vascularization including distal bypass has shown increasing
potential for successful limb salvage, even in patients with
extended tissue loss or wound infections. We have attempted
bypass surgery as a final option for limb salvage and reported
good long-term patency and limb salvage rate 5 years after
paramalleolar distal bypass in CLI patients (78.7% and 76.7%,
respectively). Complete revascularization (CR) should be
performed for all CLI patients, but it cannot be performed
because distal anastomosis sites are lacking, an available vein
cannot be used as the graft, or low cardiac function precludes
long surgery. In those patients, we perform a bypass operation
as far as possible to increase blood flow to ischemic legs for
limb salvage. We elucidate the safety and effectiveness of our
incomplete revascularization to justify our attempt to save the
leg.

Methods
We divided 74 patients with 82 critically ischemic limbs
who underwent bypass surgery from January 2014 to De-

November 2017 into two groups, the CR and non-CR groups,
and compared patient backgrounds and early postoperative
results. We studied 54 men and 20 women with a mean age of
69 years. The definition of CR is a bypass offering the neces-
sary blood flow directly to the ischemic lesion. The primary
endpoints were major adverse limb events (MALE), major
adverse cardiac events (MACE) and limb salvage (LS) at 6
months.

Results
We analyzed 70 CR limbs and 12 non-CR limbs. There was
no significant difference in comorbidities or the severity of
CLI between the two groups. There was no perioperative death
(death within 30 days). The MACE-free survival rates at 6
months in the CR and non-CR groups were 81.4% and 75.0%,
respectively (P = 0.0548). The MALE-free survival rates in
each group were 75.6% and 33.3% (P = 0.0010), whereas the
LS rates were 92.5% and 50.0% (P = 0.0003), respectively.
The MALE-free survival rates of two patients who could not
undergo CR because of the lack of a distal anastomosis site
was 0%, which was significantly lower than that of 10 other
patients who could not undergo CR for other reasons such as
lack of a vein or low cardiac function (40.0%; P = 0.0132). If
the two patients without a distal anastomosis site are excluded,
the LS rates of non-CR increases to 71.4%.

Conclusion
Our bypass operations were safely performed irrespective of
CR or non-CR. Because there was a significant difference in
MALE and LS between CR and non-CR, CR is preferable for
limb salvage. Even so, it is worth attempting non-CR because
the safely-performed operation could save some legs. The
early results of patients who could not undergo CR because
of the lack of distal anastomosis are poor and we may need to
consider primary amputation for those patients.
Objective
We describe the feasibility and the outcome of treatment for connective tissue disease (CTD) patients with leg ulcers or toe gangrene caused by critical limb ischemia.

Methods
Medical records of all patients in our hospital with diagnosed coexistent ischemic leg ulcers and CTD were reviewed retrospectively with respect to demographic data and perioperative variables.

Results
Fifteen limbs in consecutive 13 patients (all women, mean age of 68.7 years) who underwent EVT or bypass surgery were identified at our institution from July 2009 to July 2015. All patients had been suffering from intractable ischemic leg ulcers (Rutherford 5) with oppressive pain. The underlying CTD was rheumatoid arthritis in 5 patients, systemic lupus erythematosus in 1 patient, systemic scleroderma in 6 patients, and polyarteritis nodosa in 1 patient. Infrainguinal lesions were present in all cases and 93% of cases were performed EVT as an initial therapy. Initial technical success of EVT was obtained in all limbs with significant improvement of skin perfusion pressure. However, several times of EVT procedure were needed, especially in patients with systemic scleroderma (average: 2.3 times). No morbidity or mortality related to the procedure was observed. During a mean follow-up of 33.1 months 4 patients died, and major amputations were performed in 3 cases. Five cases in the 15 limbs obtained complete ulcer healing without any amputation. Minor amputations were performed in 6 cases with a complete wound healing of amputation stump.

Conclusions
CTD patients with ischemic leg ulcers can safely undergo EVT, with acceptable early outcomes achieving immediate pain-relief. However, a prospective study should be required to confirm this result.

Predictive Factors of Delayed Wound Healing and Amputation After Successful Below-the-knee Endovascular Intervention in Patients with Ischemic Foot Ulcer

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Objectives
The purpose of this study was to clarify risk factors associated with the delayed wound healing rate and amputation after successful below-the-knee endovascular intervention in patients with ischemic foot ulcer and to compare the accuracy of three representative diabetic ulcer classification systems for predicting lower extremity amputation.

Methods
Wound healing rates and limb salvage rates were analyzed retrospectively in patients who underwent successful below-the-knee percutaneous transluminal balloon angioplasty for patients with DFU between January 2014 and January 2019, 88 limbs and 84 patients. We also analyzed the independent predictors of delayed wound healing and lower extremity amputation and compare sensitivity, specificity, classification accuracy, positive predictive, negative predictive and area under the curve (AUC) values of three Diabetic foot ulcer classification systems.

Results
The cumulative wound healing rates were 16.7, 35.6, 46.9%, and 67.5% at 3, 6, 9, and 12 months, respectively. At 6 months and 1, 2, and 5 years, the repeat intervention-free rates were 89.5, 77.8, 75.6% and 69.3%, respectively; the amputation-free survival rates were 68.3, 61.9, 56%, and 48.1% respectively and limb salvage rates were 75.4, 73.3, 68.8% and 63.1%.

In a univariable Cox proportional hazards analysis, neuropathy, ambulation, ESRD on dialysis and University of Texas classification, albumin level, WIFI amputation risk, showed a statistically significant difference between the healed group and non-healed group. And also WIFI classification showed more sensitivity, specificity and accuracy, PPV and NPV and area under the curve (AUC) values than those of UT or Wagner classification.

Conclusions
The clinical status of the patient and the target limb's condition and DFU classifications are can be predictors of adverse clinical outcomes in patients with diabetic foot ulcer after suc-
cessful infrapopliteal intervention. And WIFI classification, as object Information on wound ischemic state addition to wound extent and infection would further enable the selection of suitable patients with ischemic foot ulcer for endovascular treatment.

O2-6

Techniques and Outcome of Paramalleolar Bypass Surgery to The Chronic Limb-threatening Ischemia

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Introduction

As for the treatment of chronic limb-threatening ischemia (CLTI), the limb salvage is not accomplished without revascularization. Recent years, the technology of endovascular treatment (EVT) has advanced, the value of EVT is widely recognized. But there are still some problems that restenosis highly occurs after EVT. The infringuinal bypass surgery has recommended the treatment of the first choice in those cases according to ECS guidelines in 2017. Because the durability of bypass surgery by using the auto veins is better than that of EVT. To estimate the efficacy of paramalleolar bypass grafting (PMB) to CLTI, our results were summarized in these patients. And we show the technique of PMB in our institute.

Methods

From July 2012 to June 2017, 153 limbs from 131 patients performed PMB were studied. Clinical data were collected retrospectively from the database of our hospital.

Results

Patient characteristics were: mean age, 67.7 years, 100 men (76%), ambulatory (34%), hypertension (72%), hyperlipidemia (36%), type 2 diabetes (92%) and history of ischemic heart disease (IHD) (60%). The average of ejection fraction (%EF) rate of heart and the level of serum albumin (Alb) were 56% and 3.1 g/dl respectively. All cases were classified in all three WIFI components. Cumulative primary 1- and 3-year graft patency rates were 80% and 72%, respectively, and cumulative 1- and 3-year amputation-free survival (AFS) rates were 67% and 43%, respectively. Limb salvage rates for 1-and 3-years were 94% and 84%.

Conclusion

This study shows that PMB using autologous veins can be useful in CLTI patients. But in this cohort, the life prognosis was the poor. Hence I introduce the basics of the bypass technique to those arteries in this EVT’s era.

O2-7

Venous Thromboembolism following Abdominal Cancer Surgery in The Korean Population: Incidence and Validation of Risk Assessment Model

Jeong-kye Hwang, Mi-hyeong Kim, Kang-woong Jun, Sang-dong Kim, Jang-yong Kim, Sun-cheol Park, Yong-sung Won, Sang-seop Yun, In-sung Moon, Ji-il Kim
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Background

A cancer patient slated for abdominal surgery is considered to be at moderate to high risk for developing venous thromboembolism (VTE), but in Korean patient, the incidence of VTE is quite low. Most risk assessment models and recommendations for VTE management are from Western reports and they are possible to overestimate the risk of VTE in Korean population. In this study, we assessed the incidence of VTE and the fitness of the Caprini risk scoring model in a Korean cancer patient cohort that is scheduled for abdominal surgery.

Methods

We retrospectively reviewed the medical records of 1,966 patients who were diagnosed with abdominal organ cancer and needed surgical treatment between January 2013 and December 2014.

Results

Each patient was rated using the Caprini risk scoring model. The mean score was 7.5 ± 0.7 points; 98.4% of patients were classified as high risk for VTE based on Caprini risk scoring model and American College of Chest Physicians guideline (Fig. 1). Symptomatic VTE occurred in eight patients, and the overall incidence was 0.4%. The mean Caprini score of VTE patient was 8.8 ± 1.9 points. In the group with scores between 5 and 9 points, the incidence of VTE was 0.3–0.5%. In patients with scores greater than 10 points, the incidence was found to be 1.12% (Fig. 2).

Conclusions

Korean cancer surgical patients had low incidence of VTE even though they were estimated highly risky for VTE development. The risk stratification system in the Caprini model needs to be modified based on the actual incidence in the Korean population.
What I have Learned Over Past 2 Years on VenaSeal™: For Japanese Colleague

Insoo Park
Charm Vein Center, Seoul, Korea

VenaSeal™ system is an innovative NTNT (non-thermal non-tumescent) modality for the treatment of incompetent saphenous veins. It has been approved by CE in 2011, FDA in 2015 and has been activated and several satisfactory results have been reported. In Asia, it is currently used in Korea, Singapore, Hong Kong, and Australia. And Japan is about to approve it.

VenaSeal™ showed many advantages, but as it is still a new technique, there is no consensus or widely accepted information about the detailed procedure technique or peri-procedural management required by ‘real field.’ Therefore, most starters may experience somewhat confusion and trial and error at the beginning of VenaSeal™.

From Dec 2016 to Jan 2019, author has experienced VenaSeal™ with 378 patients (642 saphenous veins) at the Charm Vein Center, Seoul. With the introduction of Japan’s approval just around the corner, we would like to share some key points based on the author’s trial and error and outcomes for the Japanese colleagues with previous reports and our data.

First, we would like to mention about the PLAR (phlebitis like allergic reaction). Many early literatures reported that ‘phlebitis’ is a most common adverse event after VenaSeal™. However, as study accumulates, it turns out that this is not a phlebitis but a hypersensitivity reaction. Therefore, it is effective to manage them in accordance with allergy treatments. In our experiences, it occurred at 25.4% of treated saphenous veins and was statistically significant more in GSV (31.8%) than in SSV (7.1%) (p < .001). And more common in epi-fascial GSV (45.8%) than in subfascial GSV (23.2%) (p = .001).

Second, sometimes an additional glue injection is efficient to treat the large vein. IFU recommends injection of 0.1 cc glue for every 3 cm, but some literatures recommend an additional injection in case of large diameter vein. The author has been doing an additional glue injection for the area with large diameter, perforating veins or branching veins. And our occlusion rate at 1 year was analyzed to be 98.5% with 253 saphenous veins ad 51.4% follow-up rate.

Third, deal with the catheter position to prevent the long remnant stump. In IFU, glue injection starts at 5 cm from SFJ. However, sometimes long remnant stump as more 3–4 cm were identified. According to our data, if the vein diameter is larger than 0.7 cm, glue propagation is significantly shorter than that of vein with diameter < 0.7 cm (p < .001). Therefore, we recommend that advancement of catheter (~1 cm) is helpful to prevent the long remnant stump for the treatment of vein with diameter ≥ 0.7 cm.

VenaSeal™ is a new treatment that has a completely different mechanism from conventional treatment. In particular, short-term results are very attractive. However, for long-term results to be more satisfactory, it is important to understand the different characteristics.

References
Poster 1

Unusual Cause of Recurrent Hemoptysis after Replacement of The Descending Thoracic Aorta

Yoshito Sakon, Takashi Murakami, Hiromichi Fujii, Yosuke Takahashi, Akimasa Morisaki, Kokoro Yamane, Noriaki Kishimoto, Toshihiko Shibata
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A 76-year-old male patient was transferred to our institute for the treatment of massive hemoptysis.

At the age of 58, he underwent replacement of the descending thoracic aorta for the chronic type B dissection, using a one-branched graft, and at the age of 66, he developed hemoptysis for the first time. Aortobronchial fistula from the pseudo aneurysm of the distal anastomosis was suspected and was treated with the stent graft. Permanent oral intake of antibiotics was introduced and the hemoptysis had ceased for 12 years. However, at the age of 76, he suffered from hemoptysis again.

Enhanced computed tomography revealed consolidated parenchyma in the segment S6 adjacent to the distal anastomosis site, consistent with the hemorrhage, but the aortobronchial fistula was not evident. The bronchial-to-pulmonary shunt was then suspected and the selective angiography was performed. The exam revealed multiple hypertrophied branches aggregated in the segment S6 adjacent to the distal anastomosis site, consistent with the hemorrhage, but the aortobronchial fistula was not evident. The bronchial-to-pulmonary shunt was then suspected and the selective angiography was performed. The exam revealed multiple hypertrophied branches aggregated in the segment S6 adjacent to the distal anastomosis site, consistent with the hemorrhage, but the aortobronchial fistula was not evident. The bronchial-to-pulmonary shunt was then suspected and the selective angiography was performed. The exam revealed multiple hypertrophied branches aggregated in the segment S6 adjacent to the distal anastomosis site, consistent with the hemorrhage, but the aortobronchial fistula was not evident.

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Descending Aorta to Abdominal Aorta Bypass via Separate Thoraco-laparotomy for The Treatment of Extensive Aortic Coarctation: A Case Report

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A 13 years-old male was transferred to our department for the treatment of aortic coarctation with uncontrollable hypertension, systemic edema, and repeating congestive heart failure. He was diagnosed of aortic coarctation at 1 month after birth. Ascending aorto-infrarenal abdominal aorta bypass was performed when he was 4 years old, however, the bypass occluded shortly thereafter. Therefore, uncontrollable hypertension with systolic blood pressure of an over 200 mmHg remained and he experienced repeated hospitalization due to congestive heart failure. Enhanced computed tomography (CT) revealed completely occluded aorta from the descending aorta at the level of Th12 to the level of the celiac artery and measuring XX cm in length. Although extensive collateral circulation to the lower extremity was present, the pulse in bilateral common femoral artery was absent. Cardiac ultrasound showed significant left ventricle hypertrophy and dilatation. At first, endovascular treatment, was attempted, however, the wire could not pass the occluded lesion. Next, descending aorta to abdominal aorta bypass via thoraco-laparotomy was performed. Two separate oblique incisions were placed in the
chest and abdomen, and a vascular graft (12 mm Triplex) was passed through the aortic hiatus without transection of the diaphragm. An end to side anastomosis with simple cramp and without cardiopulmonary bypass was performed between the distal arch and the abdominal aorta. Post operatively, systemic edema, shortness of breath and uncontrollable hypertension resolved. The systolic pressure has decreased to 140 mmHg for the first time in over 10 years and bilateral common femoral artery became palpable. Postoperative enhanced CT revealed patent bypass graft and marked improvement of the left ventricle dilatation. Postoperative course was uneventful and the patient regained normal life without restrictions. Extensive aortic coarctation that is not amenable to endovascular treatment may be effectively treated with surgical bypass via a separate thoraco-laparotomy.

P1-3

Early Results of Pulmonary Endarterectomy for Chronic Thromboembolic Pulmonary Hypertension

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Objective

In Japan, about 60 cases of pulmonary endarterectomy (PEA) for chronic thromboembolic pulmonary hypertension (CTEPH) are applied annually. We started PEA treatment in 2015, in collaboration with an interdisciplinary expert team including cardiologists, radiologists, and surgeons. We evaluated the clinical characteristics and early outcomes of PEA in our cohort.

Patients and Methods

This retrospective study included 13 PEA consecutive patients between April 2015 and December 2018 at Keio University Hospital. Eight patients (61.5%) were female and the median age was 60 years old. Eleven patients (84.6%) had a history of acute pulmonary embolism and/or deep vein thrombosis. The PEA procedure was performed with intermittent circulatory arrest for a period limited to 15 min with deep hypothermia maintained at 18 degrees Celsius in central temperature according to the University of California, San Diego. An additional cardiac procedure was performed in 7.7% (n = 1; coronary artery bypass graft).

Results

All the patients survived after PEA. During a mean follow-up period of 26.4 months, no patient died. The median operation time, extracorporeal circulation time and circulatory arrest time were 389.4 min (318–419 min), 290.5 min (197–304 min), and 59.5 min (27–77 min), respectively. Initial ventilation time was 1 day (1–3 days). In addition, intensive care unit and postoperative hospital stay were 3 days (2–9 days) and 19 days (13–43 days), respectively. Before PEA, mean pulmonary artery pressure (PAP) was 41.7 ± 9.1 mmHg and mean pulmonary vascular resistance (PVR) was 868.8 ± 389.6 dynes·sec·cm⁻⁵. Compared to before PEA, we observed significant improvements in the PAP (20.9 ± 9.1 mmHg; p < 0.05) and the PVR (290.0 ± 128.0 dynes·sec·cm⁻⁵; p < 0.05) at discharge. Of 13 patients, 3 (23.1%) had a perioperative complication, including hemoptysis, pulmonary reperfusion edema, and persistent pulmonary hypertension, but no need for extracorporeal membrane oxygenation after surgery. Three patients had recurrent PH after complete removal of thrombi. Recurrent PH was thought to be the result of poor compliance of anticoagulation, 1 patient needed additional balloon pulmonary angioplasty (BPA) to reduce pulmonary hemodynamics, and the others needed only medical therapy. We performed hybrid therapy with PEA and additional BPA for 3 patients, BPA before PEA in 2 cases and BPA after PEA in 2 cases. BPA before PEA was safe for reduction of very high PVR exceeding 1,400 dynes·sec·cm⁻⁵ with small vessel disease in addition to proximal thrombi, and BPA after PEA was effective for incomplete removal thrombi, residual small vessel disease and recurrent thrombi due to poor anticoagulation.

Conclusions

Our PEA strategy improved objective variables including pulmonary hemodynamics, with low rate of the periprocedural complication. Additional BPA before and/or after PEA as hybrid therapy for CTEPH may be a safe and effective procedure. Future collaborative studies with cardiologists, radiologists, and surgeons are needed to establish the therapeutic strategy for CTEPH.

P1-4

Modified Limb Sandwich Technique for Complex Aorto-iliac Lesions Unfit for Custom Made Stent-grafts

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Objective

We report our experience of limb sandwich technique for complex aorto-iliac lesions unfit for custom made stent-grafts.

Materials and Methods

We retrospectively reviewed 5 patients (mean age, 76.5 ± 5.32 years) with aorto-iliac arterial lesions; 2 type III
endoleaks following endovascular aneurysm repair (EVAR); 1 endotension following EVAR; 1 type Ia endoleak following EVAR for isolated iliac artery aneurysm; 1 intramural hematoma (IMH) at infrarenal aorta with small aortic diameter. All lesions were unsuitable for endovascular treatment with custom made devices. Both of the type III endoleaks following EVAR was due to the mechanical disruption of the flow divider. Two limbs of EVAR device was inserted up to the renal artery to fill the aorta or pre-existing EVAR device lumen without gutter leak or endoleak. The two parallel stent-grafts' diameter was determined by two methods. One is geometrical calculation of arc length and the other is by the isoperimetric inequality equation. Technical success and complication rates were measured.

Results
The technical success rate was 100%. There was one procedure related complication. One patient with re-do procedure following EVAR, left renal artery was accidentally covered due to higher deployment than planned. There was one early complication in patient with IMH with small aortic diameter. The left limb was thrombosed by limb competition which was successfully recanalized. Patients were followed-up for a mean of 19.01 ± 18.64 months (6.67–45.67 months). One patient, the first case of limb sandwich technic, died of rupture on 29 months after the procedure. This patient had endoleak by limb separation during follow up but refused to treat and finally died.

Conclusions
The sandwich technique might be enlisted among the bailout options to treat aorto-iliac lesions unfit for custom made devices.

P1-5
The Impact for The Patient who Required Urgent Operation of Ruptured Abdominal Aneurysm under The Telemedicine Information Sharing System in Hokkaido

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Background
In Hokkaido as the largest island in Japan, 80% of cardiovascular surgeons gathered in three big cities. This is one of reasons there are big difference of medical care quality between the patient in the big city and the patient in the local city that the absence of cardiovascular surgeon, whom required the urgent surgical treatment for cardiovascular diseases. Especially for the ruptured abdominal aortic aneurysm case, rapidly and precise diagnosis for treatment orientations before patient arrival and as soon as possible to start of the surgical treatment are necessary for the improvement of the treatment outcomes. In our Hospital, We build up the telemedicine information sharing system using the secured cloud server for urgent cardiovascular case aiming at the rapidly and precise diagnosis with 6 hospitals which were cardiovascular surgeon absence.

Aim of this Study
We compared treatment outcomes of ruptured abdominal Aortic aneurysm case (included iliac artery aneurysm case) required urgent surgical treatment between under the telemedicine information sharing system (CLD group) and without the system (CON group).

Materials and Methods
The case treated for ruptured abdominal aortic and iliac aneurysms was 19 cases (including 3 iliac artery aneurysm cases) during 2015 through 2019 January. 17 cases were male. The average age was 76.9 years old. Eight cases (42.1%) were using the telemedicine information sharing system.

Results
All patients were received urgent EVAR operation successfully. In the CLD group, it became needless to add re-diagnosis with computed tomography after hospital arrival (p < 0.05). It was able to shorten the period from the hospital arrival to operating room admission (p < 0.01). Furthermore, it was able to avoid worsening of vital signs before starting operation (p < 0.05). Eight cases were performed additionally endo-close of the aneurysms rupture hole. Four cases of them were able to evade the onset of abdominal compartment syndrome. All treated cases were alive when they were discharged from the hospital.

Conclusion
We can diagnose and decide treatment strategies for the ruptured abdominal aortic aneurysm case by using the telemedicine information sharing system before patient arrival and can start appropriate treatment quickly.

P1-6
Single Center Experience of Endovascular Aneurysm Repair for Ruptured Abdominal Aortic Aneurysm

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Purpose
Endovascular aneurysm repair (EVAR) for ruptured abdomi-
nal aortic aneurysm (AAA) has been increasingly advocated due to short term benefits. But, it is realistically difficult to prepare devices of all sizes for ruptured AAA in Korea. This study analyzed the results of EVAR for ruptured AAA (rEVAR) and compared with the results of elective EVAR (eEVAR) in our institution.

Method
From January 2010 to December 2017, 129 patients with AAA underwent EVAR by bifurcated devices in our institution. Among them, 16 patients (12.4%) underwent rEVAR. We investigated the clinical characteristics of patients, the anatomy of AAA, the details of operation and the perioperative mortality. We also analyzed the results using two sample t-test and chi-square test.

Result
There were no statistical differences in clinical characteristics of patients between rEVAR and eEVAR. The maximal aneurysm diameter of rEVAR group was larger than eEVAR group (70.27 cm vs. 54.21 cm, \( P = 0.000 \)) but AAA neck anatomy structures (neck diameter, length and angle) were not different (\( P = 0.145, 0.211 \) and 0.305). There was a significant difference in the number of stent graft (4.06 vs. 3.40, \( P = 0.01 \)) due to the increase in the number of limb extension (2.94 vs. 2.37, \( P = 0.002 \)). The difference in the diameters of stent graft and AAA necks showed a significant difference between the two groups (7.01 mm vs. 4.66 mm, \( P = 0.009 \)). Operative time was shorter (136.06 min vs. 192.02 min, \( P = 0.025 \)) and mortality was higher (31.25% vs. 3.54%, \( P = 0.000 \)) in rEVAR group.

Conclusion
Because there was no difference in AAA neck anatomy with rEVAR, there was no difference in the additional procedures of the neck of AAA. However, there was a difference between the diameter of stent graft and neck, and the number of stent graft due to limb extension increased due to the limitations of available devices. rEVAR is an important option for treating AAA patients with acceptable time and mortality.

P1-7
Successful Endovascular Repair of Abdominal Aortic Aneurysm Presenting Aortoduodenal Syndrome

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P1-8
Systemic Inflammatory Disease and Its Association with Aneurysm Sac Shrinkage after EVAR

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The 11th Japan-Korea Joint Meeting for Vascular Surgery

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**Backgrounds**

Endovascular aortic repair (EVAR) for abdominal aortic aneurysms (AAA) is a minimally invasive surgery, but has late complications problems such as enlargement or rupture of the aneurysm sac due to postoperative endoleak and endotension. Recently, it has been reported that systemic inflammatory diseases cause persistent inflammation and remodeling of the aortic wall, resulting in aneurysmal degeneration. We hypothesized that C reactive protein (CRP), which is an indicator of inflammatory response, is a predictor for failure of aneurysm sac shrinkage after EVAR, and examined the relationship between high-sensitive CRP and aneurysm sac shrinkage.

**Methods**

From October 2013 to September 2017, 177 patients underwent EVAR using Gore G3 Excluder at our university hospital, in which the level of high-sensitive CRP was measured in 137 patients. The patients consisted of 114 male and 23 female with a mean age of 75.8 ± 7.2 years. Aneurysm sac size was defined as the maximum minor-axis diameter on an axial CT scan. Aneurysm sac size was compared between that on baseline preoperative CT and that on postoperative CT scans. Change in aneurysm sac size ≥ 5 mm was considered as significant, whether due to enlargement or shrinkage.

**Results**

Aneurysm sac size of patients with high level of high-sensitive CRP showed a significant decrease, from 52.8 ± 11.9 mm to 46.8 ± 10.19 mm (p < 0.01) at 1 year. At 1 year postoperatively, aneurysm sac shrinkage (≥ 5 mm) was observed in 83 of 137 patients (60.5%), and a stable aneurysm sac (< 5 mm) was noted in 45 of 137 patients (32.8%). The mean preoperative CRP was 0.49 ± 1.03 (mg/dL). Univariate analysis revealed preoperative CRP (p = 0.008), preoperative WBC (p = 0.021), rupture (p = 0.026), renal cyst (p = 0.766), outside of the IFU (p = 0.023). Multivariable analysis demonstrated that preoperative CRP (OR 1.88; 95%CI 1.03–3.42; p = 0.040), renal cyst (OR 0.34; 95%CI 0.15–0.76; p = 0.009) were significant risk factors affecting overall mortality.

**Conclusions**

High-sensitive CRP was a risk factor for failure of aneurysm sac shrinkage. This suggests that systemic inflammation influence remodeling of the aneurysm sac, thereby suppressing aneurysm sac shrinkage after EVAR.

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**P1-9**

**Anatomical Factor is Associate with The Development of Post-implantation Inflammatory Response after EVAR for AAA**

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**Objectives**

The objective of this study was to evaluate the impact of anatomical factor on the post-implantation syndrome (PIS) after elective endovascular aneurysm repair (EVAR) of abdominal aortic aneurysms (AAAs).

**Methods**

From January 2014 till August 2018, 51 consecutive patients treated electively by EVAR for AAA were prospectively included. PIS was defined according to systemic inflammatory response syndrome criteria. The anatomical factors were determined by preoperative computed tomography angiogram; the volume of thrombus in the aneurysm sac, tortuosity score of AAA and iliac artery, neck length and diameter, iliac artery diameter was measured. The results were correlated to the occurrence of post-implantation syndrome (PIS) as well as to the main clinical and laboratory components of PIS: fever; increased white blood cell (WBC) count and C-reactive protein (CRP) level.

**Results**

PIS was diagnosed in 13 (21.3%) patients. The volume of mural thrombus in AAA sac (p = 0.02) was the only independent risk factor of PIS. The iliac artery involvement (p = 0.087), degree of thrombus or calcification in the iliac artery (p = 0.196), embolization of unilateral IIA (p = 0.317), AAA tortuosity index (p = 0.473), IA tortuosity index (p = 0.308), diameter of aneurysm (p = 0.141), hostile neck (p = 0.254) and the device type (p = 0.604) were not found to significantly affect of the development of PIS.

**Conclusions**

A systematic inflammatory response is observed in a significant number of patients after elective EVAR. The volume of mural thrombus in the sac is associated with the development of PIS after EVAR. Large scale analysis was needed.

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**P1-10**

**A case of Antegrade Transapical Branch Deployment in Endovascular Aortic Arch Repair with In Situ Fenestration**

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Zone 0 thoracic endovascular aortic repair (TEVAR) usually requires reconstruction of the supraaortic vessels to some extent. This is routinely performed by accessing the aorta through the subclavian, axillary, or carotid arteries, and less commonly via a direct thoracic aorta puncture. Here, we have described a patient for whom the left ventricular apex was the most suitable access to the supraaortic branches during in situ fenestrated TEVAR.

Case

The patient, a 76-year-old man, had presented with a saccular aortic arch aneurysm. Due to a severe aortic atheroma distal to the aortic arch, recurrent strokes, bilateral carotid plaque, chronic kidney disease, and frailty, he was considered inoperable, even with an endovascular technique. However, the aneurysm expanded over the last one year; thus, an alternative treatment was explored. He underwent a transapical deployment of a stent graft (CTAG 37-200), followed by puncturing the graft from the right and left common carotid artery via a 6-Fr. sheath. Branch grafts for the brachiocephalic and left common carotid arteries were inserted via the left ventricular apex and were subsequently deployed. Intraoperative angiogram verified complete exclusion of the aneurysm without endoleak. This access should be considered as an alternative approach, if conventional arterial access is not appropriate.

Echocardiography-guided Aortic Cannulation by The Seldinger Technique for Type A Dissection with Cerebral Malperfusion

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Objective

The purpose of this study was to assess the efficacy of echocardiography-guided ascending aortic central cannulation using the Seldinger technique during surgery for type A acute aortic dissection complicated by stroke due to cerebral malperfusion.

Methods

Between April 2007 and December 2017, 208 patients with type A acute aortic dissection underwent echocardiography-guided ascending aortic central cannulation using the Seldinger technique. We analyzed 16 of these patients (7.7%; median age 63 years, 8 males) with stroke due to cerebral malperfu-
Surgical Strategies of Aorto-esophageal Fistula, Effectiveness of Staged Surgery

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Introduction
The incidence of aorto-esophageal fistula (AEF) is very rare, but fatal entity, occurring at approximately 0.04% to 0.07%. Recently, due to increase of thoracic aortic diseases, the occurrence of secondary AEF after thoracic aortic graft replacement or thoracic endovascular aortic repair (TEVAR) also has increased. The classical treatment of AEFs has been surgical replacement of the thoracic aorta with esophagectomy. However, primary surgical repair of AEFs is difficult for the patients with critical conditions. Bridge TEVAR is one useful option for acute bleeding from AEF, however the total treatment strategies for AEF has not been established.

Patients
Between January 2011 to January 2019, 13 patients suffering from AEF were treated. Of them, 8 patients were enrolled in this study, excluding 5 patients who underwent TEVAR for esophageal cancer. The mean age was 63.1 (41–80) years old, and 6 were male. All of the cases presented secondary AEF after open aortic repair in 3 and TEVAR in 5. The aortic pathologies were non-dissecting thoracic aneurysm in 2, chronic type B aortic dissection in 5 and acute type A aortic dissection in 1. Three patients had hemorrhagic shock and 7 had septicemia.

Results
Refampicin-bonded Dacron graft replacement, esophagectomy and omentopexy were performed for 4 patients, simultaneous esophageal reconstruction was carried out for one patient. Emergency TEVAR was performed for 4 patients, three of whom were converted to definitive TEVAR and staged esophagectomy. Removal of stent graft, extra-anatomical bypass (ascending to abdominal aorta), direct repair of esophagus and staged in-situ latissimus muscle flap implantation for 1 patient with MRSA infection. In the last 3 patients thoracoscopic esophagectomy was carried out. At the mean follow-up of 20.0 (2–53) months, in-hospital mortality occurred in 2 patients; aorto-bronchial fistula and septicemia 8 months after definitive TEVAR and, septicemia 3 months after extra-anatomical bypass and direct repair of esophagus. Remote death was seen in 2 patients; one cerebral hemorrhage due to rupture of the mycotic cerebral aneurysm 48 month later and one coronary artery disease 13 month later. The over-all mortality and infection-related mortality at 1 year were 68.5% and 68.5%, respectively. The 1-year mortality was 80.0% after open repair and 50.0% after TEVAR (P = 0.624).

Conclusion
Both open repair and TEVAR of AEF are associated with high mortality. Early-stage esophagectomy was effective for control systemic infection. Definitive TEVAR with early-stage esophagectomy is one treatment option for high-risk patients.

Extra-anatomical Bypass and Stentgraft Resection for Secondary Aorto-enteric Fistula to Sigmoid Colon after Endovascular Abdominal Aortic Aneurysm Repair; A Case Report

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We report a case of a 65-year-old female of secondary aorto-enteric fistula (AEF) to sigmoid colon after endovascular abdominal aortic aneurysm repair (EVAR). Initial EVAR was performed for abdominal aortic aneurysm (AAA) with a size of 50 mm. After 1 year, she complained of low back pain. Enhanced computed tomography (CT) revealed contained rupture of the AAA with aneurysm sac enlargement to 81 mm due to type Ia endoleak. Therefore, emergency EVAR with snorkel technique for the right renal artery stent was performed. Furthermore, 4 years from initial EVAR, sac embolization using coils and N-Butyl Cyanoacrylate were performed for type II endoleak via inferior mesenteric and lumbar arteries. However, aneurysm sac continued to enlarge. Although we recommended to the patient to undergo aneurysmorrhaphy, she refused surgery and conservative management was continued on an outpatient basis. Six and half years after initial EVAR, she visited the emergency room complaining of abdominal pain, fever (39°C), and melena. Enhanced CT confirmed AEF
to sigmoid colon with air around the stentgraft and inside the sac and adjacent to the sigmoid colon. Surgical treatment consisted of extra-anatomical bypass (axillo–bilateral femoral bypass), followed by laparotomy and en bloc resection of the stentgraft and the sigmoid colon. Subsequently, Hartmann’s procedure and omentum patch for the removal site of the stentgraft were performed. Escherichia coli was found in the blood culture and therefore, piperacillin/tazobactam was administered intravenously, then de-escalation to ampicillin/sulbactam and cefmetazole for first 4 weeks, followed by oral cefaclor for an additional 6 months. Postoperative course was uneventful, and the patient was discharged home on the 32nd postoperative day. Recurrence of infection is not observed in follow up periods. Sac growth is a significant risk factor for AEF and sac infection and therefore preemptive and definitive treatment including aneurysmorrhaphy should be performed prior to sac infection. Extra-anatomical bypass and infectious material resection is highly invasive but is lifesaving.

**P2-3**

**Clinical Outcomes after Internal Iliac Artery Embolization Prior to Endovascular Aortic Aneurysm Repair**

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**Objectives**

Internal iliac artery (IIA) embolization is required when the iliac landing zone is not sufficient during endovascular aortic aneurysm repair (EVAR) procedure. Pelvic ischemia is an important complication of IIA embolization, but incidence and severity of actual occurrence is not exactly known. We analyzed the clinical outcomes of patients who underwent IIA embolization to facilitate EVAR in our institution.

**Methods**

From November 2005 to June 2018, 498 cases of EVAR were performed in our institution. Among these, 139 cases that needed IIA embolization were reviewed based on telephone interview and medical chart review. We classified the severity of buttock claudication according to the previously defined pain scale.

**Results**

Among 139 patients, 126 patients underwent unilateral IIA embolization, and the rest of 13 underwent bilateral IIA embolization prior to EVAR. Embolic material used were coils (n = 99), Amplatzer vascular plugs (n = 28), and mixed (n = 12). The median interval for the sequential bilateral IIA embolization was 21 day (range 11–41). There was no critical complication such as buttock necrosis, spinal cord ischemia, or ischemic colitis. Also, there was no severe buttock claudication requiring surgical intervention or medication for pain relief.

**Conclusion**

Based on our experience, IIA embolization does cause buttock claudication of a certain degree. However, the most of them experienced mild discomfort which did not affect the quality of life. Considering operative risks, complications and complexity of surgical reconstruction procedures, IIA reconstruction may not be necessary in the majority of patients.

**P2-4**

**Factors of Mural Thrombus in Branch Graft of Internal Iliac Artery Using Branched Endovascular Aneurysm Repair**

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**Background**

When common iliac artery (CIA) aneurysm (CIAA) is treated, branched devices such as the EXCLUDER iliac branch endoprosthesis (IBE) which is designed to preserve the internal iliac artery (IIA) during endovascular aneurysm repair (EVAR) is used. However, we sometimes encounter mural thrombus in branch graft of internal iliac artery (Fig.). The purpose of this study is to identify the factors of mural thrombus in branch graft of internal iliac artery.

**Methods**

From October 2017 to February 2019, 30 patients underwent elective EVAR with the branched EVAR device included EXCLUDER IBE (20 patients) and combination of some devices (10 patients) for CIAA and CIAA with IIA aneurysm at 3 institutions. In those, 18 patients had bilateral CIAAs, 12 patients had unilateral CIAAs, and 6 patients had IIA aneurysm. In order to investigate the cause of mural thrombus, we analyzed size of implanted device, diameter of IIA, distal landing position, number of branch artery, and diameter of branch artery using preoperative and postoperative computed tomography scans. In 5 cases, we also examined the pressure at landing position before device implantation.

**Results**

Mural thrombus in graft was detected in 8 cases (27%) and
there were no case of occlusion of branch graft. Sole ExcluderIBE use was 2 cases combination use was 6 cases. In the case of formation of mural thrombus, the ratio of the superior glutereal artery landing (thrombus: 6, no thrombus: 2) was large, and diameter of branch artery of IIA was small, particularly in cases where the diameter of the IIA is more than 2.5 times that of the branch artery (the diameter gap between IIA and branch artery was large). The pressure at landing position in the case with mural thrombus were slightly lower than cases without thrombus.

Conclusions
The mural thrombus in IIA branch graft occurred in 27% cases who underwent EVAR with the branched EVAR device. The present results suggested that occurrence of thrombus may be associated with the superior gluteal artery landing and the small diameter of branch artery. However, the number of cases were very small, further studies will be needed.

Surgical Repair for Coral Reef Aorta Syndrome
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Background
Coral reef aorta syndrome presents with heavily calcified polypoid atherosclerotic lesions from the thoracoabdominal aorta, which always induces severe aortic stenosis above renal arteries. The pathology is the same to middle aortic syndrome and atypical aortic coarctation. If accompanying visceral artery stenosis or not, it results in significant visceral and lower limb ischemia. Revascularization procedures range from open surgical repair to endovascular therapy. However, although endovascular therapy is performed with less invasive than open surgical repair, it is with high risk of rupture, extension failure and re-stenosis of stent graft.

Objective
We presented several cases for considering surgical strategy for coral reef aortic syndrome with multivessel visceral stenosis.

Case Presentation
Case 1: A 72-year-old male with postprandial abdominal pain after meals and intermittent claudication for 10 min with numbness and right calf pain from over 10 years ago. Computed tomography (CT) showed a thick calcified plaque occluding the thoracoabdominal aorta. The celiac axis was stenotic and the superior mesenteric artery was completely occluded, with an aneurysm (17 mm) at the origin of the inferior mesenteric artery. Aortic rerouting from the ascending aorta to the infra-renal aorta was performed, with reconstruction of the superior mesenteric artery by saphenous vein bypass and transplantation of the inferior mesenteric artery to the bypass prosthesis, resulting in complete relief of the ischemic symptoms.

Case 2: A 69-year-old man presented with chronic renal dysfunction and intermittent claudication from several years ago. CT revealed that a saccular type aneurysm (68 mm) on the middle aortic arch with shaggy aorta syndromes, and severe atherosclerotic diffused stenosis from the thoracoabdominal aorta above celiac artery to infrarenal aorta with middle aortic syndrome. Aberrant right subclavian artery was originated from the distal aortic arch, bilateral renal arteries was stenotic induced renal dysfunction. Total aortic arch replacement procedure was performed. Before weaning from the cardiopulmonary bypass, we established an extra-anatomical bypass from the ascending aortic graft to the femoro–femoral crossover bypass graft. He was discharged from hospital with improvements in intermittent claudication, hypertension, and renal dysfunction.

Case 3: A 75-year-old man presented with deterioration of intermittent claudication from two months ago. He had long term history of arteriosclerosis obliterans treated by endovascular stent in bi-iliac arteries. CT showed severe stenosis induced by massive thick calcified plaque from thoracoabdominal aorta to supra-renal arteries. The right iliac artery was instent restenosis. We performed grafting bypass from the right axillary artery to bi-femoral arteries. Intermittent claudication was disappeared postoperative.

Discussion
Coral reef aorta (CRA) is characterized by heavily calcified polypoid lesions originating from the thoracoabdominal aortic junction, or extending to infra-renal aorta with severe stenosis, which always combined with visceral artery stenosis including superior mesenteric artery (SMA), renal artery (RA) and celiac artery. Because it is a rare clinical entity, it poses a significant therapeutic challenge. Patients usually exhibit signs
of bowel ischemia, limb claudication, renal dysfunction and hypertension. Endovascular surgery (ES) was performed successfully for CRA patients with simple lesions. Although it has high risk of embolism events and rupture, with less invasive to patients. If it combines with the stenosis of RA or SMA, we can perform percutaneous transluminal angioplasty or with stent. However, lot of patients shows diffuse stenosis from the thoracoabdominal aorta to infra-renal aorta, and combined with several visceral artery stenosis, so we think that surgical repair is the best treatment choice for these patients. But we have to consider bypass graft inflow location from aorta according to aortic stenosis lesion. In the present cases, they had complicated lesions, so we performed surgical repair including grafting reconstruction to aorta and visceral arteries, and got sufficient satisfactory clinical outcome.

Conclusion
Surgical repair with reconstruction of visceral arteries is efficacious in coral reef aorta syndrome.

Factors Associated with Long-term Patency of The Graft after Lower Extremity Arterial Bypass

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Objectives
In an endovascular era, patients undergoing lower extremity arterial bypasses (LEABs) have been decreased in its number. However, it is well known that treatment efficacy of LEAB is more durable compared to that of endovascular treatment. There have been many reports regarding risk factors for graft failure after LEABs. In this study, we attempted to determine factors associated with long-term patency after LEAB for patients with chronic atherosclerotic LE arterial occlusive disease.

Methods
We performed a retrospective analysis using a single institution database of patients who underwent LEABs due to chronic atherosclerotic LE arterial occlusive disease during the past 13 years. PTFE grafts were used only in above-knee popliteal artery bypass while vein graft was used in below knee arterial bypasses. Most of the vein graft were reversed saphenous vein grafts. Long-term patency was arbitrarily defined as primary or assisted primary patency longer than 7 years after graft implantation. Graft patency was determined with periodic examinations of duplex US following LEABs. We compared demographic, clinical features, bypass procedures, comorbidity and atherosclerotic risk factors and postoperative managements between patient groups with long-term (≥7 years) patent graft and graft occlusion confirmed before 7 years after LEAB. To determine factors associated with long-term graft patency, we conducted univariable and multivariable analyses using multiple logistic regression model.

Results
Among 789 LEABs during the study period, 226 limbs (145 limbs with graft occlusion before 7 years and 81 limbs with patent grafts for ≥7 years after LEAB) were included at 86 months (median, IQR 39.5–103.5) after LEABs. LEABs for non-atherosclerotic disease or trauma (n = 139 limbs), patent graft for shorter postoperative follow-up than 7 years (n = 153 limbs), lost to follow up (n = 202 limbs) and death (n = 69 limbs) were excluded from the analysis. On a multivariable analysis, younger age (increase OR, 0.949/year of age, CI95%, 0.912–0.988; P = 0.011), claudication (versus CLI, OR, 2.326; CI95%, 1.095–4.941; P = 0.028), absence of hyperlipidemia at preoperative examination (versus hyperlipidemia, OR, 2.350; CI95%, 1.135–4.866; P = 0.021), above the knee popliteal artery bypass (versus more distal artery bypass, OR, 6.257; CI95%, 2.245–17.437; P < 0.001), vein graft (versus prosthetic graft, OR, 7.021; CI, 2.736–18.018; P < 0.001), secondary procedure for the failing vein graft (versus no secondary procedure after LEAB, OR, 6.516; CI 1.985–21.392; P = 0.002) were associated with long-term graft patency after LEAB.

<table>
<thead>
<tr>
<th>Table</th>
<th>Multivariable analysis to determine factors associated with long-term graft patency after lower extremity arterial bypass (LEAB)</th>
</tr>
</thead>
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<tr>
<td>Reference</td>
<td>Odds ratio (95%CI)</td>
</tr>
<tr>
<td>Age</td>
<td>Increase OR, 0.949 (0.912–0.988)/year of age</td>
</tr>
<tr>
<td>Claudication</td>
<td>Critical limb ischemia</td>
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<tr>
<td>Normotensive</td>
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<tr>
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<td>Hyperlipidemia</td>
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<tr>
<td>No prior intervention</td>
<td>Prior arterial intervention in target limb</td>
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<tr>
<td>Vein graft</td>
<td>Prosthetic graft</td>
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<tr>
<td>A–K arterial bypass</td>
<td>B–K arterial bypass</td>
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<tr>
<td>Secondary procedure for failing graft</td>
<td>No secondary procedure</td>
</tr>
</tbody>
</table>

(by Logistic regression analysis)
Conclusion
To achieve long-term efficacy of treatment for patients with chronic atherosclerotic LE arterial occlusive disease, above factors can be helpful in choosing treatment modality between endovascular and LEAB.

P2-7
A Five-year Experience with Heparin-bonded Expanded Polytetrafluoroethylene Graft for Below-the-knee Bypass in The Era of Endovascular Surgery
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Objective
To evaluate the patency and outcomes of heparin-bonded expanded polytetrafluoroethylene graft (Propaten graft; W. L. Gore & Associates, Flagstaff, Ariz) in below-the-knee bypasses.

Methods
We retrospectively reviewed consecutive below-the-knee bypasses for femoropopliteal occlusive disease with the Propaten graft from October 2013 to September 2018. A total of 27 limbs in 23 patients were identified. The mean age of patients was 75 years and 82% were male. The indication for revascularization were disabling claudication in 15 (55.6%) limbs, rest pain in 3 (11.1%) limbs, and tissue loss in 9 (33.3%) limbs. The morphology of lesions in all patients were TASC II type C with heavily calcified popliteal artery or type D. All grafts implanted were 6 mm in a diameter. The proximal anastomosis was located either at the common femoral artery or the external iliac artery and the distal anastomosis was located either at the below-knee popliteal artery or the tibioperoneal trunk.

Results
The mean follow-up period was 22.8 months. Six patients were lost to follow-up. The 6-, 12-, and 24-months primary graft patency rates were 83.9%, 63.7%, and 63.7%, respectively. The 6-, 12-, and 24-months secondary graft patency rates were 95.8%, 77.2%, and 71.3%, respectively. No patients developed heparin-induced thrombocytopenia. There was one graft infection. The overall limb salvage rate was 92.5% and the overall mortality rate was 17.4% during the period.

Conclusions
When a suitable saphenous vein is unavailable, the Propaten graft can be an acceptable alternative for knee-crossing revascularization even in the era of endovascular surgery.

P2-8
Predictive Factors for Amputation Free Survival After Paramalleolar Bypass Surgery in Critical Limb Ischemia Patients with Hemodialysis
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Introduction
As for the treatment of critical limb ischemia (CLI), the limb salvage is not accomplished without revascularization. In patients who are not at high risk of surgery, paramalleolar bypasses using autogenous vein grafts have been indicated as a first-line treatment. However, it is not easy to predict the postoperative prognosis after bypass surgery. In general, the end stage renal disease with hemodialysis (HD) patients are exposed to the risk of the amputation due to CLI, but are considered at high risk of surgery. To estimate the prognosis after bypass surgery in HD patients with CLI, our results were summarized in these patients after paramalleolar bypass grafting.

Methods
From July 2012 to June 2017, 153 limbs from 131 patients performed pallamaleor bypass grafting were studied. Clinical data were collected retrospectively from the data base of our hospital and analyzed using univariate and multivariate methods.

Results
Patient characteristics were: mean age, 67.7 years, 100 men (76%), ambulatory (34%), hypertension (72%), hyperlipidemia (36%), type 2 diabetes (92%) and history of ischemic heart disease (IHD) (60%). The average of ejection fraction (%EF) rate of heart and the level of serum albumin (Alb) were 56% and 3.1 g/dl respectively. All cases were classified in all three WIfI components. Cumulative primary 1- and 3-year graft patency rates were 80% and 72%, respectively, and cumulative 1- and 3-year amputation-free survival (AFS) rates were 67% and 43%, respectively. Limb salvage rates for 1- and 3-years were 94% and 84%. Univariate analysis identified six significant predictors of AFS: ischemic grade >3 (P = 0.021), foot infection grade >3 (P = 0.049), ambulation status (P = 0.015), the history of IHD (P = 0.024), %EF <40% (P < 0.001) and the level of Alb <3g/dl (P < 0.001). %EF (HR, 3.271; 95%CI, 1.735–6.166) and the level of Alb (HR, 3.241; 95%CI, 1.910–5.500) were identified as independent factors negatively with AFS in HD patients by multivariate analysis.

Conclusion
This study shows that paramalleolar bypass using autologous veins can be useful in CLI patients with HD. But in this
cohort, the condition of %EF and the value of Alb are the significant predictors of AFS.

**P2-9**

**Treatment of Long Femoropopliteal Lesions with Drug-coated Balloons (DCB), Outcome from Single Center**

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**Objective**

The treatment modalities of peripheral arterial occlusive disease have been recently developed. In the literature, the results of drug-coated balloon (DCB) have been published as good patency. However, using DCB for treatment of long femoropopliteal lesions (>15 cm) has a short period of experience. We evaluated the outcomes of drug-coated balloon (DCB) for treatment of long femoropopliteal lesions in terms of clinical data and patency.

**Methods**

All patients underwent primary PTA using at least 2 DCBs on femoropopliteal lesions were reviewed. TASC II classification was also recorded by preoperative CT angiography. We evaluated the overall primary patency, primary-assisted patency, secondary patency at 6, 12, 18, and 24 months. The patency after PTA with DCB expressed through Kaplan–Meier curve.

**Results**

We identified patients 47 with complex femoropopliteal lesion (>15 cm) who received PTA using at least 2 DCBs from Nov 2015 to Dec 2017. The mean age was 70.44 ± 7.00 years old and male dominant 40 persons (86.8%). The mean lesion length was 25.71 cm. The distribution number of DCBs used is two 31 (65.9%), and three 16 (34.0%). The primary patency was 88.1%, 83.3%, 83.3%, and 75.8% at 6, 12, 18, and 24 months. The primary-assisted patency was 94.2%, 89.3%, 84.6%, and 76.9% at 6, 12, 18, and 24 months. The secondary patency was 97.8%, 92.9%, 83.0%, and 76.0% at 6, 12, 18, and 24 months.

**Conclusions**

Although it is a short term follow-up study, the results were acceptable for treatment long femoropopliteal lesions. In the future, it will be necessary to long term follow up.

**P2-10**

**New Endarterectomy Methods Used Ultrasonic Aspiration Device for Heavily Calcified Peripheral Arterial Occlusive Disease**

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**Objective**

In recent years, with the change in disease structure, the number of patients with complications of diabetes, chronic renal dysfunction has been increasing. In classical arteriosclerotic pathology, calcification occurs in the medial smooth muscle layer of the arterial wall, but in medial arterial calcification, which is common in diabetes, chronic renal dysfunction, and maintenance dialysis patients, wall structure destruction and calcification commonly occur.

Although femoral endarterectomy is a standard procedure, approximately 2–3% of cases require common femoral artery (CFA) replacement as a result of heavily calcification attached to the wall. The CFA wall will become extremely thin following the procedure, making it difficult to hold sutures.

So, we developed the new concept “to create a new lumen to dig a tunnel into the dollop calcification” used a surgical ultrasonic aspiration device ‘SONOPET’ (Stryker Corp., USA).

**Materials and Methods**

We used a new method based on the following criteria. All cases were performed CT before surgery.

1) Cases with heavily calcification such as occupying lumen in CFA, which is difficult to reconstruct in standard procedure.
2) During operation, case in which calcification can be seen through the vessel wall, and it is expected that almost no adventitia will remain when calcification is peeled off.
3) There are parts of the vessel wall that can be incised/ sutured on the distal side of calcification.
4) CFA can be linearized.

Even if we consider as an indication of a new method before surgery, if we can perform with a standard procedure during the operation, do standard procedure.

The SONOPET devices have been developed as surgical instruments that are capable of simultaneously resecting and removing body tissue, such as the CUSA system (Integra LifeSciences Corp., USA). The hard tissue cutting tip of SONOPET device is called a bone curette, and it is possible to cut calcification with a combination of longitudinal vibration and torsional vibration tip. Because calcified structures do not
absorb ultrasonic oscillation, the SONOPET devices cut bone smoothly and efficiently. Underlying soft tissue vibrates with oscillation and moves away from the vibrating tip, remaining largely unaffected.

Handpieces of SONOPET devices has angled or straight 25kHz models, and the diameters of the vibrating tips are 3.12 mm, and the tips on 360 degrees. The thickness of the wall to be left was checked by confirming the vibration of the tip of the SONOPET devices with a sense transmitted through palpation from the outside of the calcified lesion blood vessel. In this way, it was possible to prevent the damage of the blood vessel wall, but for that reason, it was necessary to sufficiently separate the vessel in the operative area.

Results
We performed this technique in three patients who had PAD with dollop calcification at CFA. We succeeded in performing endarterectomy without damage to the vessel wall. And we can make to secure the luminal. CT image revealed that the lumen was in good condition even 1 year after the operation.

Conclusion
It is not an alternative to the standard procedure. It can be new option that our new method is heavily calcifications limited to CFA, which is difficult to operate under direct vision endarterectomy in order to preserve the vessel wall that could withstand incisions and sutures at the peripheral lesion.

Wound Outcomes after Femoro-popliteal Endovascular Treatment for Patients with Ischemic Tissue Loss

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Objective
This study aimed to investigate the wound outcomes after vascular interventions for atherosclerotic femoro–popliteal lesions in patient with ischemic tissue loss.

Method
A retrospective review of data after 135 endovascular procedures for femoropopliteal atherosclerotic lesions causing tissue loss between May 2010 and February 2018 was performed. Final wound outcome was categorized as: Group A, Wound healing without recurrence; Group B, Wound recurrence after healing; Group C, Persisting wound regardless of toe amputation (C1, without forefoot amputation; C2, Wound healing after forefoot amputation; C3, Persisting wound even after forefoot amputation), Group D, Major amputation performed or refused.

Results
Mean age was 70.7 ± 8.7 years, and 73.3% were male. Diabetes (69.6%) and renal insufficiency (45.2%) were common comorbidities. During follow-up (mean duration 22.3 ± 19.5 month), 73 limbs (54.1%) were categorized as group A (Wound healing without recurrence), and 11 limbs (8.1%) were group B (Wound recurrence after healing). Wounds persisted in 33 limbs (24.4%) regardless of toe amputation, and categorized as group C (C1, without forefoot amputation [29, 21.5%]; C2, wound healing after forefoot amputation [3, 2.2%]; C3, persisting wound after forefoot amputation [1, 0.7%]). Eighteen limbs (13.3%) which needed major amputation were categorized group D. In group D, below knee amputation was performed in 13 limbs, and refused by patients or family members in 5 limbs. According to this final wound outcome, limb salvage rate at 1-yr, 3-yr, 5-yr were 87.4%, 84.4%, 84.4%, respectively, and amputation-free survival at 1-yr, 3-yr, 5-yr were 72.1%, 48.2%, 39.4%, respectively.

Conclusion
Endovascular treatment for femoro–popliteal lesions is an effective therapeutic modality, however it showed poor outcomes in patients with ischemic tissue loss when we focused on detailed wound outcome. Considering that significant proportion of patients suffer from persisting wound, whether major amputation is actually performed or not is not appropriate endpoint for estimating the treatment outcome. Expected wound outcome and survival expectancy must be used in clinical judgment.
P3-2

Comparison with Selective Shunting Based on EEG Monitoring and Routine Shunting for Carotid Endarterectomy

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Objective

This study aimed to compare the clinical characteristics between routine shunting and selective shunting based on EEG monitoring when performing carotid endarterectomy.

Method

We retrospectively reviewed medical records of 84 CEA performed in 80 patients from May 2010 to December 2018. Our vascular center changed the policy for CEA. Before May 2017, routine shunting (n = 67) was performed without EEG monitoring. After May 2017, EEG monitoring was performed under general anesthesia and selective shunting (n = 17) was performed only when there was a change in EEG.

Results

The mean age of EEG monitoring group and no EEG monitoring group was 70.18 ± 7.325 and 68.97 ± 7.544, respectively. There was no statistical difference in the clinical characteristics between the two groups, including HTN (p = 0.348), ischemic heart disease (p = 0.083), DM (p = 0.547), smoking (p = 0.295), symptomatic patients (p = 0.679) or contralateral stenosis (p = 0.661). The operation time was 119.47 ± 22.575 min at EEG monitoring group and 152.81 ± 46.671 min at no EEG monitoring group, respectively (p = 0.005). There was no statistical significance for newly formed lesions on MRI images after CEA (p = 0.543).

Conclusion

Selective shunting based on EEG monitoring for CEA can reduce the operation time and convenience of operation without increasing the perioperative stroke.

P3-3

Advantages of Combined Method in the Treatment of Varicose Vein

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Introduction

Several methods have been tried in the treatment of varicose
vein. Since each method has advantages and disadvantages, it is important to choose the treatment method that suits the patient's condition. The author tried to maximize the advantages of each method in the treatment of varicose vein by using a cryostripping on proximal part with minimum incision and high-ligation (HL) of GSV and an endovenous laser ablation (EVLA) on distal part of GSV.

**Objective**

From January 1st to December 31st, 2015, the diameter of the GSV was more than 5 mm (the diameter standard is at least 3 cm from SFJ to distal), and HL and cryostripping was performed on the proximal part of GSV, and distal part of GSV received EVLA at least 10 cm length.

A total of 69 people were eligible, with men/women = 51/18 persons, average age = 50.49/54 years, average diameter of GSV men/women = 7.02/6.92 cm, and CEAP C3/C4 = 29/22 males and 12/6 females. Total of 90 GSV enrolled and in male 70 GSV were included (right: 39, left: 31) in female 20 GSV were included (right: 9, left: 11). Re-surgery was not included. The assessment was finalized in early February 2019 (about 3–4 years of observation).

**Method**

After a transverse incision about 0.5 cm from 2 cm below saphenofemoral junction (SFJ), open the saphenous fascia slightly with a sharp mosquito clamp and lift the GSV up, perform an HL (Fig. 1) and advance the cryoprobe as far as possible to the distal side. Before stripping, sufficiently infuse tumescent solution mixed with epinephrine and lidocaine around GSV to reduce pain and bruising.

After stripping, Subsequently, the remaining GSV diameter can be found to be reduced to less than half of original (Fig. 2). EVLA carried out with energy of about 30–40 J/cm on remnant GSV. EVLA or sclerotherapy was performed on the branch vessels of GSV.

**Result**

No recurrence was observed around SFJ among patients who underwent surgery. Five additional sclerotherapy were performed. three of which were recanalization of GSV (3/90 GSV, 0.033%) and two of which were due to insufficient previous sclerotherapy. All finished with one procedure. Side effects such as saphenous nerve damage or hematoma, skin burns were not observed. The bruises and pain in the stripping area were most severe about the third day after the operation and did not cause much discomfort to daily life. no changes in AASV, PASV were observed.

**Consideration**

The development of intravenous procedures, including EVLA, can reduce post-operational pain, hematoma, and adjacent organ damage by reducing physical trauma during surgery, and thus shorten the recovery period. It is also possible to reduce the possibility of new blood vessel formation (neovascularization) by performing ablation from about 2 cm below SFJ to maintain normal blood flow around the SFJ. EVLA has many advantages, but the risk of recanalization is a weak point. The probability of recanalization after EVLA may vary from study to study, and there are so many variables that it is difficult to specify, but other studies or our experience suggest that large diameter of GSV or insufficient linea endovenous energy density (LEED) in EVLA is major contributing factor. To avoid recanalization excessive energy may be needed but it can make the fibrous cord or cause skin burn or coloration, damage to surrounding nerves or tissue.

Several factors are discussed as causes for neovascularization: hypoxia, various growth factors, such as vascular endothelial growth factor, vascularization of the hematoma, scar-vascularization, free endothelial cells and high venous blood pressure. But the pathogenesis of neovascularization is not yet clearly understood. There are some report of increased recurrence by the formation of neovascularization around SFJ after HL and stripping. But minimizing the opening of the fascia, holding up the GSV to minimize physical damage, and letting GSV stump be placed under the fascia make chance of recurrence low. It is also possible to remove AASV or PASV if the vision is good during surgery. The distal region is performed about 30 cm of stripping, reducing the possibility of intervenous connections, reducing the incidence of new blood vessels by not interfering with the blood flow of other normal veins.
This is a way to make the most of the benefits of cryostripping. And through the reduction of the volume in the residual GSV of the distal region after stripping, the remaining GSV were consumed with less energy and thus reduced the possibility of further complications and recanalization. The commonly recommended LEED is about 60 to 70 J/cm, but with about half that energy, we were able to achieve successful results.

**Conclusion**

Combined treatment is a method that can safely perform HL and stripping with minimal physical damage and overcome the limitations of EVLA. But there are more things to prepare in the operating room, such as disinfection, surgical equipment, and skilled assistants, rather than ablation only surgery. And if the patient is obese, the operation itself can be difficult and it needs a relatively longer running curve, but I think it can be overcome by some familiarity.

When the diameter of the GSV is large or EVLA alone is unstable, combined method can be considered as a good option.

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**P3-5**

**Prophylactic Anti-coagulation to Prevent Thrombotic Complication Following Endo-venous Thermal Ablation for The Leg Varicose Veins**

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**Objective**

Although endo-venous thermal ablation became the standardized safe treatment of leg varicose veins, it still has the possibility to provoke the venous thrombotic complications. Our current prophylactic usage of direct oral anticoagulants for the high-risk patients of post-operative thrombotic complication is reported.

**Method**

From September 2015 through December 2018, 2,368 operations have been performed by single surgeon to treat leg varicose veins. Among them, 2,298 cases were endo-venous thermal ablations. There was no mortality, no serious complication, no infection. One remote deep venous thrombosis was noticed with an elderly male patient three months after his operation. There was no patient showing EHIT class 3 or 4. Class 2 EHITs were recorded with 12 cases, and class1 were with 78 cases. Anticoagulation was employed along with 158 thermal ablative operations. Patient selection was done by an operator considering the risk from patients’ age, obesity, the proximal diameter of saphenous veins, and other conditions. Twenty-seven cases with previous or ongoing venous thrombosis, 11 cases with continuous anti-coagulation for chronic atrial fibrillation, and 2 cases on letrozole were excluded from this study. The rest of 118 cases were retrospectively reviewed to clarify the patients’ background, methods of administering anticoagulants and their effects.

**Result**

Among 118 cases, there were 82 women and 36 men. Average age was 65.8 ± 12.4 years old. Obesity was found with 20 cases. Great saphenous veins were treated with 108 cases, and small saphenous veins were with 10 cases. Average proximal saphenous vein diameters were 11.5 ± 2.4 mm with patients younger than 75, and 13.0 ± 2.8 mm with patients older than or equal to 75. Oral edoxaban 30 mg once daily was given for all 118 cases. Average period of administration was 36.7 ± 27.5 days (1–122 days). Among these 118 cases, there was no deep venous thrombosis, and no EHIT class 2–3. Two cases of class 1 EHIT was noticed. Side effects including 2 nasal bleeding, 1 gingival bleeding, and 1 uncomfortable feeling occurred.

**Conclusion**

Prophylactic anti-coagulation following endo-venous thermal ablation for the leg varicose veins was effective for the high risk patients of post-operative venous thrombotic complications. Since it has the possibility of causing side effects including bleeding problems, meticulous dosing method and follow-up is essential.

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**P3-6**

**Safety and Efficacy of Performing Short-Term Endovascular Treatment for Acute Lower Extremity Deep Vein Thrombosis Using Low-Dose Urokinase in a Single Session with a Single Venous Access Approach**

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**Purpose**

To evaluate the safety and efficacy of performing short-term endovascular treatment for acute lower extremity DVT using low-dose urokinase in a single session with a single venous access approach. To evaluate the efficiency of placing IVC filter through the same popliteal vein access site used for endovascular treatment.

**Materials and Methods**

From October 2003 to June 2015. Ninety-eight patients with symptomatic acute DVTs were analyzed. Symptom durations of all patients were under 14 days. Durations of urokinase infusions were not over 8 h. All endovascular procedures (including IVC filter insertion in a single session, through a single access site). No contraindication for thrombolytic agents. IVC
filter insertions were performed 33 patients out of 98 patients. IVC thrombus &/or a large amount of a thrombus without underlying vascular stenosis on CT Venography were performed endovascular treatment by popliteal vein approach in the leg with the venous thrombosis. Double-basket shaped retrievable IVC filters (OptEase filter; Cordis, Warren, NJ, USA) with a 90-cm introducer set. Deployed in the infra-renal IVC under fluoroscopic guidance were used.

Results
Female patients were 62 patients. Mean age was 62.6 years. Locations of thrombosis were left in 88 patients. DVTs with May–Thurner syndrome was 68 patients. Iliofemoral affected in 53 patients. Iliopopliteal affected in 25 patients and IVC involved in 22. All patients were performed with short-term endovascular treatment for acute lower extremity DVT using low-dose urokinase in a single session with a single popliteal venous approach. Mean urokinase infusion time was 181 ± 76 min. Mean total urokinase in single dose was 5.16 ± 2.76 × 104 IU and mean total continuous infusion dose was 33.49 ± 13.08 × 104 IU. Immediate success rates were 100%. Primary patency rate at 6 months and 12 months were 82% and 79%. Total prophylactic IVC filter placements were 33/98. Follow-up CTV data obtained within 2 wks of procedure 26/33. Significant filter tilt was found in 3 cases out of these 26 patients. So, significant filter tilt rates (≥ 15°) was 11.5%.

Conclusion
Short-term endovascular treatment using low-dose urokinase in a single session with a single venous access approach is a safe and effective method for treating symptomatic acute lower extremity DVT. Transpopliteal IVC filter insertion is an efficient therapy that results in low rates of significant filter tilt and enables a single-session procedure using a single venous access site for filter insertion and endovascular procedures for DVT.

Catheter-direct Thrombolysis Plus Aspiration Thrombectomy Versus Catheter-directed Thrombolysis Plus Pharmacomechanical Thrombectomy for The Treatment of Lower Extremity Deep Vein Thrombosis

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Purpose
Early thrombus removal techniques that improve venous patency, preserve valve function, and show strong potential to prevent post-thrombotic syndrome has been widely accepted as a treatment of lower extremity deep vein thrombosis (DVT), especially in patients with iliofemoral DVT. And pharmacomechanical thrombectomy (PMT) using AngioJet™ is the latest treatment option that seems to be associated with lower complication rates, especially the risk of systemic bleeding. The aim of this study is to compare the treatment outcome in patients who underwent either catheter directed thrombolysis (CDT) plus aspiration thrombectomy (AT) and CDT plus PMT for the treatment of lower extremity DVT.

Materials and Methods
From May 2017 to December 2018, 40 patients with acute proximal DVT were enrolled in this retrospective study. Twenty patients (50%, mean age 66 years) underwent CDT plus AT and the other twenty patients (50%, mean age 68 years) underwent CDT plus PMT using Angiojet™. Clinical data and radiological images were retrospectively reviewed. The diagnosis of DVT was confirmed by computed tomographic (CT) venography. The lower extremity thrombosis (LET) classification was applied to classify patients according to thrombus location and extent. The thrombus clearance was judged by venography and graded as follows: thrombus clearance < 50% was defined as grade I, 51–75% as grade II, and grade III > 75%. And grade III (> 75%) was considered as successful outcomes. Comparisons were made with regards to the treatment outcome between the two groups.

Results
In both groups, complete or partial thrombus removal was accomplished in 17 (85%) and 3 (15%) cases, respectively. Significant reductions in the thrombolytic therapy duration and total dose of urokinase were noted in the CDT plus PMT group (thrombolytic duration 21.6 ± 16.2 h, total urokinase dose 1.38 ± 0.82 million unit) when compared to the CDT plus AT group (thrombolytic duration 35.3 ± 18.2 h, total urokinase dose 2.03 ± 0.96 million unit). There were 2 complications in the primary CDT plus AT group: minor oozing. In the CDT plus PMT group, gross hemoglobinuria was present in 17 (85%) patients, but urine color returned to normal within 24 h after surgery. No adverse events such as renal dysfunction, bleeding were recorded in the CDT plus PMT group.

Conclusion
CDT plus PMT using Angiojet™ is an effective treatment modality for the treatment of lower extremity DVT. When compared to CDT plus AT, this treatment strategy provides similar treatment success with reduced thrombolytic therapy duration and total dose of urokinase.
NARA Socks Project Aiming at a Spread of Compression Therapy and a Revival of Local Industry

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Background
In Japan “Monozukuri” stands for the manufacturing industry and its spirituality and culture. It is not only making things but also Japanese traditional technique in pursuit of advanced production by the craftsmen. Koryo-cho with a population of 30 thousand called “Town of Socks” is the largest producer of socks traditionally here in Japan. These manufacturers are highly reputed for their technical skills and capabilities, and supply products to such overseas luxury brands. However, due to the large quantity of imported products to Japan, the production volume has dropped greatly from the peak period. And Japan is a country with many disasters because of island. It is necessary to enlightenment to prevention of thrombosis at the time of disaster to the people. I asked medical institutions, stocking manufacturers, and university students in local for cooperation. As a result, one elastic stocking was completed. The purpose of the activity is enlightenment of prevention of thrombosis and reconstruction of local industry.

Methods
The research period is from January 2017 to March. There are 30 objects (M14/F16, 34.5 ± 9.3). We investigated changes in the circumference of the leg below the knee and improvements in the blood circulation of the legs before and after using the compression stockings with sonogram and investigated a compression pressure while wearing the stockings (Fig. 1).

Results
The results revealed that the circumference of the leg below the knee showed a decreasing tendency after wearing the compression stockings. The peak velocity of the popliteal vein tended to increase 20 min after wearing the compression stockings (Fig. 2).

Conclusion
The compression stockings seemed to be effective for promoting venous return and preventing deep vein thrombosis of the lower limbs in healthy people. I am hoping to reduce the suffering caused by human thrombosis and revive the local industry.

Experience of Intravascular Ultrasound (IVUS) Guided Iliac Vein Stenting for May-Thurner’s Syndrome

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Introduction
Multiplanar venography for iliac veins stenting is limited by insufficient information for decision making and malposition of stent around narrow lesion. Intravascular ultrasound (IVUS) is known to be effective in iliac vein stenting for May-Thurner’s syndrome.

Material and Method
This is retrospective study from prospectively registered database of patients, who underwent pharmacomechanical catheter directed thrombolysis (PCDT) for acute iliofemoral DVT from Apr. 2012 to Feb. 2019. The treatment procedures
and outcomes of patients who underwent PCDT under IVUS guide was evaluated with EMR and PACS. IVUS was used to evaluate lesion after PCDT and to evaluate location and position of stent after iliac vein stenting.

**Result**

Twenty patients from 117 patients were included in this study. There were 8 men and the mean age was 68.2 years old. IVUS localized the location of narrow lesion compressed by iliac artery and vertebral body in 19 cases. There was one case of no localized narrow lesion in IVUS, which was observed without iliac vein stenting. IVUS found residual thrombus in 3 cases, which needed additional PCDT. The iliac vein stenting was done in 18 cases. The mean diameter of stent was 14 mm in common iliac veins. There was placement of one stent in 17 patients, two stents in 1 patient and three stents in 1 patient. There was no post procedural stent thrombosis. There was poor apposition of iliac vein stenting to vein wall in 1 patient, which needs additional balloon angioplasty.

**Conclusion**

The IVUS can localize the narrow lesion in PCDT and measure the vein diameter for vein stenting and evaluate post stenting wall apposition, which support early technical success and possible long term patency.

**P3-10**

Long Term Results of Snuffbox AVF as The First Choice of Vascular Access

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**Purpose**

As the survival of hemodialysis patients have prolonged, importance of long-term use of AVF as a vascular access is much more increasing. Snuff-box AVF is known as the superior method among shunt method in the point of the lengthening of in-use vessel. However, currently snuff-box AVF is regarded as the method of choice only being applied in limited circumstances where the condition of artery and vein is good, and vessels have enough size for the anastomosis. So usually snuff-box AVF is not accepted as the first choice of AVF and the number of doing also minimal. However, I think there are many snuff-box AVF available cases much more than people’s considering. In our hospital, two surgeons make AVF and only I accept the snuff-box AVF as the first choice of operation of autologous vein AVF. I analyse the results of snuff-box AVF patency rate and compare it with the other surgeon’s radiocephalic AVF and all the AVG of both.

**P3-11**

Angiojet™ Thrombectomy in Patients with Thrombotic Occlusion of AV Access

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**Introduction**

Angiojet™ of the Boston Scientific is a new device that can be used together with mechanical thrombectomy and pharmacologic thrombolysis. This new device is available for both arterial and venous thrombus and is known to be particularly effective for acute thrombus. We report here on the experience of Angiojet™ thrombectomy; percutaneous mechanical thrombectomy (PMT) in AV access thrombotic occlusion.

**Methods**

A total of 30 patients with Thrombotic occlusion of arteriovenous access for dialysis undergoing percutaneous mechani-
cal thrombectomy (PMT) between July 2018 and January 2019 were included. The heparin we used was mixed with 1,000 cc of normal saline and 5,000 units of heparin, and the urokinase was mixed with 100 cc of normal saline and 100,000 units of urokinase. The patient’s clinical character, AV access types were evaluated. And the amount of urokinase used and amount of heparin used in the operation were checked. The total operation time, PMT time, urokinase pharmacologic thrombolysis waiting time were checked. Postoperative complications and amount of intraoperative bleeding were investigated to confirm the patient’s outcomes.

Results

The total number of patients was 30 and 11 were male and 19 were female. The mean age of the patients was 69.03 years (52–86 years). The native vessel had 1 case and the remaining 29 cases were AVG type. Diabetes mellitus was found in 22 patients (73%) and hypertension was found in 27 patients (90%).

The average period of use after AVF creation was 23.13 months. The amount of urokinase used and amount of heparin used in the operation were 73.2 cc and 103.6 cc. The total operation time, PMT time and Urokinase pharmacologic thrombolysis waiting time were 56.2 min, 149.3 sec and 16.2 min. all patient confirmed stenotic lesion, and all stenotic lesion was resolved with percutaneous balloon angioplasty.

The primary patency rate was 66.3%, 52.4% and 52.4% at 1 month, 3 months and 6 months, respectively, and the secondary patency rate was 82.6% at 1, 3 and 6 months.

Conclusion

Angiojet™ is really effective device for remove thrombus by combined mechanical thrombectomy and pharmacologic thrombolysis. The application of this device is safe and effective for the treatment of not only DVT, arterial thrombotic occlusion, but also thrombotic occlusion of AV access.

In this study, it was confirmed that AV access patients could be used particularly useful in graft. However, large data were not collected yet and long-term outcome was not confirmed, so we cannot confirm superiority when compared with conventional surgical thrombectomy. However, there is less bleeding, incision is not needed and there is no blood volume reduction. It has the advantage of providing comfort to the surgeon because there is no huge bleeding.

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