

Monday, January 13, 2014 - Trunk/Torso Scientific Paper Session - 11:15am - 12:15pm

11:15am - 11:19am

Venous Thrombosis in Handsewn vs. Coupled Anastomoses in 857

Consecutive Breast Free Flaps

Anita R. Kulkarni, MD; Babak J. Mehrara; Andrea L. Pusic; Peter G. Cordeiro; Evan Matros; Colleen M. McCarthy; Joseph J. Disa; Memorial Sloan-Kettering Cancer Center

Institution where the work was prepared: Memorial Sloan-Kettering Cancer Center, New York, NY, USA

Background:

The Anastomotic Coupling Device has demonstrated safety and efficacy in microvascular anastomoses for free tissue transfer. Our institution transitioned to the routine use of the coupler for venous anastomoses in breast reconstruction approximately five years ago. We hypothesized that rates of venous thrombosis requiring revision would be lower using the coupler versus handsewn anastomoses.

Methods:

We performed a retrospective review utilizing clinic records, hospital records, and operative reports for 857 consecutive breast free flaps at a single institution from 1997-2012. Data was collected on type of reconstruction, recipient vessels, timing (immediate vs. delayed), laterality (unilateral vs. bilateral), preoperative radiation, preoperative chemotherapy, venous thrombosis, and flap outcome. We compared rates of venous thrombosis requiring anastomotic revision between handsewn and coupled anastomoses for all breast free flaps. Chi square test was used to calculate statistical significance.

Results:

A total of 857 consecutive free flaps were performed for breast reconstruction in 647 patients over 16 years. The venous anastomosis was handsewn using 8.0 or 9.0 nylon suture in 303 flaps, and the anastomotic coupler was used in 554 flaps. Most free flaps performed were muscle-sparing transverse rectus abdominis myocutaneous (MS-TRAM, 50.4%) or

deep inferior epigastric perforator (DIEP, 41.3%) flaps. The handsewn group was more likely to utilize the thoracodorsal system for recipient vessels, while the coupled group was more likely to utilize the internal mammary system. The coupled group was more likely to be reconstructed in a delayed fashion, to be unilateral, and to receive chemotherapy and radiation. The rate of venous thrombosis requiring anastomotic revision in the handsewn group was 0.04% (12/303), compared to 0.01% in the coupled group (8/554; $p=0.02$).

Conclusion:

The anastomotic coupler was more effective in preventing venous thrombosis than handsewn anastomoses in our series. Previous studies have shown similar rates of thrombosis between coupled and handsewn anastomoses, though no study to our knowledge has focused exclusively on breast reconstruction to compare the two techniques. While our study demonstrates improved patency rates using the venous coupler in breast reconstruction, we were unable to definitively separate this finding from potential confounding variables due to the low rates of thrombosis in both groups. Our data is consistent with current literature, which suggests that the coupler is a safe and effective alternative to hand sutured anastomoses.

11:19am - 11:23am

In-Vivo Quantitative Evaluation of Perfusion Zones and Perfusion Gradient in the Deep Inferior Epigastric Artery Perforator Flap

Chrisovalantis Lakhiani, MD¹; Angela Cheng, MD²; Michael Mangum¹; Karel Zuzak¹; Sumeet Teotia, MD¹; Michel Saint-Cyr, MD³; (1)University of Texas Southwestern Medical Center, (2)UT Southwestern Medical Center, (3)Mayo Institution where the work was prepared: University of Texas Southwestern Medical Center, Dallas, TX, USA

Background: The selection of well-vascularized tissue during DIEP flap harvest remains controversial. While several studies have elucidated cross-midline perfusion, further characterization of perfusion to the ipsilateralhemiabdomen is necessary for minimizing rates of fat necrosis or partial fat necrosis in bilateral DIEP flaps.

Methods: Eighteen patients (29 flaps) underwent DIEP flap harvest using a prospectively designed protocol. Perforators were marked and imaged with a novel system for quantitatively measuring tissue oxygenation, the Digital Light HyperspectralImager. Images were then analyzed to determine if perforator selection influenced ipsilateral flap perfusion.

Results: Flaps based on a single lateral row perforator (SLRP) were found to have a higher level of hemoglobin oxygenation in Zone I (mean %HbO₂ = 76.1) compared to single medial row perforator (SMRP) flaps (%HbO₂ = 71.6). Perfusion of Zone III relative to Zone I was similar between SLRP and SMRP flaps (97.4% vs. 97.9%, respectively). These differences were not statistically significant (p>0.05). Perfusion to the lateral edge of the flap was slightly greater for SLRP flaps compared SMRP flaps (92.1% vs. 89.5%, respectively). SMRP flaps had superior perfusion travelling inferiorly compared to SLRP flaps (88.8% vs. 83.9%, respectively). Overall, it was observed that flaps were better perfused in the lateral direction than inferiorly.

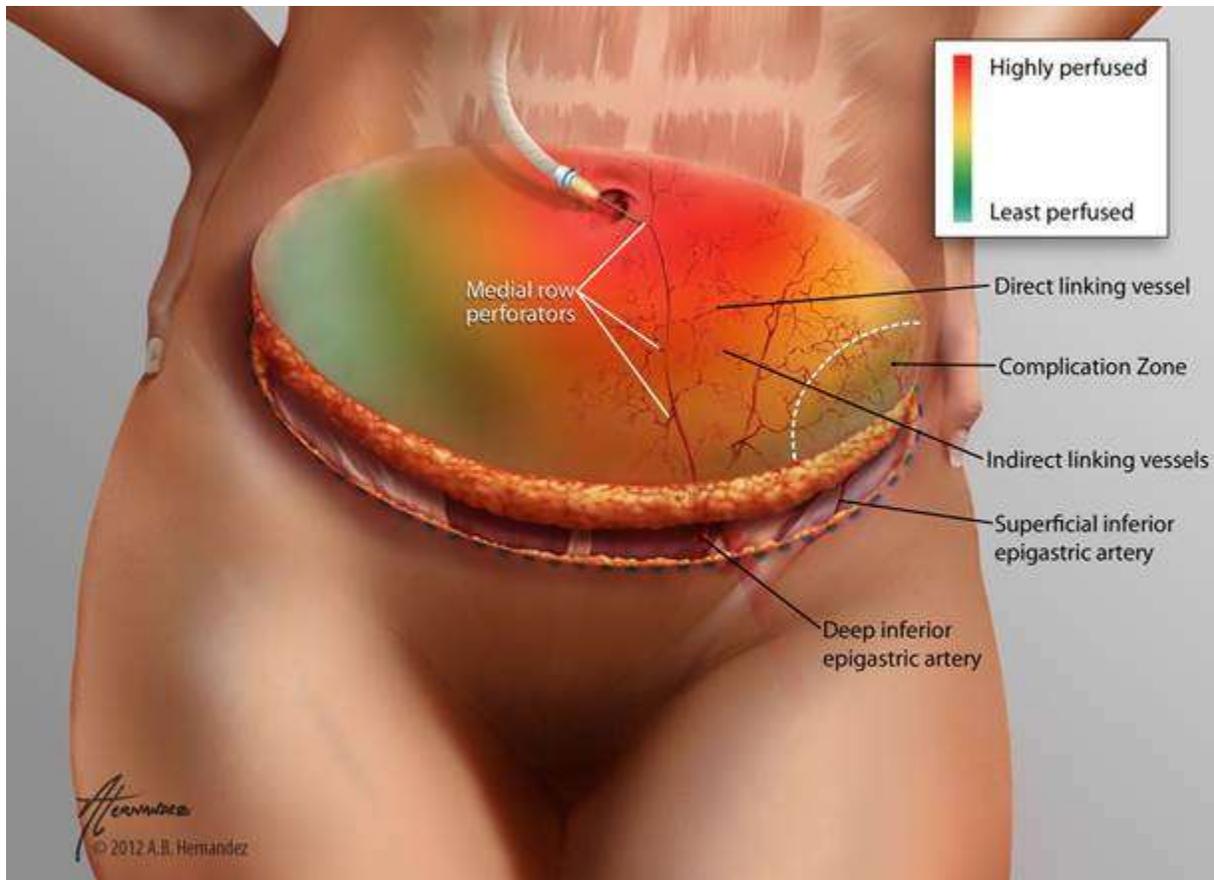
Conclusions: Significant differences in perfusion gradients directed inferiorly or laterally were observed, and perforator selection influenced perfusion in the most distal or inferior aspects of the flap. This suggests broader clinical implications for flap design that merit further investigation.

Figure 1. Characterizing DIEP Flap Perfusion Gradients



Hyperspectral Image with Gradient Overlay. Sampling image pixels across the skin flap in the lateral and inferior directions, as indicated by the black arrows, results in plotting a decreasing tissue oxygenation gradient toward the flap edge from the perforator. A black x represents the skin flap perforators as identified by the surgeon.

Figure 2. Areas of Maximal DIEP Flap Perfusion



This figure illustrates areas of maximal perfusion within the deep inferior epigastric artery perforator (DIEP) flap observed in this study.

11:23am - 11:27am

Delayed Chimerism of Flaps

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Institution where the work was prepared: China Medical University Hospital, Taichung, Taiwan

BACKGROUND: For reconstruction of a complex defect it may require several flaps based on the same vascular pedicle, such as two skin flaps for different locations, or multiple flaps of different tissue components such as skin and bone, skin and muscle, etc. Each of the flap should be completely viable. However, their viability can be compromised when multiple flaps are sutured to different locations at the same time. The reason can be compression, kinking or tension of perforators supplying these component flaps during the procedure of inset, especially in the reconstruction of three-dimensional defects.

PATIENTS AND METHODS: For the reason of safety, we have used the principle of delayed chimerism. Proper marking was made over the perforator of each component flap for easy identification in the second procedure. One (or two) of the component flaps whose blood supply might be compromised were only partially sutured to the defect in the first operation. When the swelling of wound has subsided and there was neovascularization from peripheral tissue, the flap(s) can be mobilized or divided for definitive inset to final destination. This method was indicated in the following situations: (1) when one of the perforators was small, (2) in old patients, (3) in the environment of potential infection, (4) when three-dimensional inset might cause problems for one (or two) component flaps.

RESULTS: In 34 out of 38 free flaps there was complete survival of all component flaps. Only 4 cases had re-exploration and one had total failure, the other 3 were salvaged successfully. The time between the first operation and second procedure was from 1 week to 15 days. It allowed circulatory stabilization/ neovascularization to occur and ensured healing without partial loss of a component flap.

CONCLUSION: This method is a combination of conventional surgery and microsurgical principle. It is useful in difficult wounds. Total survival of any tissue component is the base to achieve good functional and aesthetic results.

11:27am - 11:31am

Risk Factors and Costs Associated with Early Failure in Complex Abdominal Wall Reconstruction: A 5 Year Single Surgeon Experience

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Introduction

Large ventral hernias pose a significant surgical challenge. As such, complex abdominal wall reconstruction (AWR) is commonly performed but with a significant rate of surgical complications and hernia recurrence. The aim of this experiential review is to assess risk factors for morbidity and cost with an emphasis on hernia recurrence in complex AWR.

Methods

A retrospective review of AWR patients from 2007- 2012 was performed. Rates of surgical and medical morbidity were assessed, as well as total cost associated with AWR. Univariate analyses and subsequent multivariate logistic regression analysis was used to assess independent predictors of early hernia recurrence.

Results

134 consecutive cases (Age= 50.2 ± 13.8 years, BMI= 32.4 ± 9.4 kg/m²) of AWR were performed by a single surgeon over a 5 year period at a large academic teaching center. Large traumatic open abdomens (33.6%) and previous failed repair (32.8%) were the most common indication for complex AWR. Major surgical complications affected 37 individuals (27.6%), with 14 (10.4%) of these patients experiencing hernia recurrence. The average time to hernia recurrence was 8.54 ± 5.14 months, with infection being the most common cause of a failed repair. The average total cost of repair was approximately 100% greater in patients who underwent a hernia recurrence when compared to a successful repair, although the initial length of hospital stay appeared equal between both groups (P=0.91). Multivariate logistic regression analysis revealed that hernias derived from trauma (OR 11.00, P=0.01) and those who experienced post-operative wound infections (OR 14.59, P<0.01) were at increased risk for hernia recurrence.

Conclusions

This large case-series of complex AWR emphasizes the significant morbidity and costs of this challenging operation. Increased vigilance must be paid to patients presenting after trauma with massive loss of domain and significant counseling of those who experience post-operative infection, as these cohorts are at added risk for failed reconstruction.

11:39am – 11:43am

Replacing Like with Like: An Algorithmic Approach Towards Total Functional Abdominal Wall Reconstruction

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Institution where the work was prepared: University of Manitoba, Winnipeg, Canada

Introduction: Restoration of the functional abdominal wall remains one of the greatest clinical challenges facing the reconstructive surgeon. No single operation can be reliably chosen for all abdominal wall defects. Complexities such as defect dimensions, remaining function of the abdominal wall, presence of infected mesh, ostomies, enterocutaneous fistulas and radiation changes all serve to guide treatment choices. An algorithmic approach should benefit the plastic surgeon in choosing a reconstructive procedure for this challenging patient population.

Methods: A retrospective review of abdominal wall reconstructions performed at our institution over a 5 year period was conducted. Patient characteristics, procedures performed and outcome data were assessed. The algorithm used to choose treatment options was also described.

Results: 46 patients met inclusion criteria. Average BMI was 27.2. Enterocutaneous fistulas were present in 40% of patients, ostomies in 30%, and exposed, infected mesh in 41%. Mean number of previous abdominal surgeries was 3. In total, component separations alone were used in 19 patients, while component separations with synthetic mesh were used in 4 patients for defects of 16 cm or more. Synthetic mesh was added only in clean wounds. Component separations were combined with acellular dermal matrix for six patients, all with defects greater than 16 cm in contaminated or infected wounds. Free flaps were chosen for 17 patients, being indicated for clean or infected wounds with absolute tissue loss of both rectus abdominis muscles, or infected wounds with absolute fascial tissue loss of 16 cm or more. Two free flap patients underwent flap loss, due to pedicle avulsion from the deep inferior epigastric artery perforator recipient vessels. Due to this complication, the intra-abdominal gastroepiploic vessels became the chosen recipient vessels. Seven of the patients who received free flaps had innervated chimeric rectus femoris - anterolateral thigh (ALT) free flap reconstruction, which was chosen due to a loss of bilateral rectus abdominis muscles. In these cases, acellular dermal matrix was used as an underlay, followed by chimeric rectus femoris-ALT flaps restoring the normal anatomy of the fascia - muscle - fascia interface of the functional abdominal wall.

Using this algorithm, primary healing was achieved in greater than 80% of patients.

Conclusions: Individualized treatments are often required for patients undergoing abdominal wall reconstruction. Using an algorithm that includes microvascular reconstructive options to reconstruct the abdominal wall to as close to normal anatomy as possible provides a high degree of primary healing in this complex patient population.

11:43am - 11:47am

The Pedicled ALT: a Viable Option in Abdominal Reconstruction

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Institution where the work was prepared: The Ohio State University Medical Center, Columbus, OH, USA

Background: Defects of the abdomen are a common problem facing the reconstructive surgeon. Advancing techniques and technology have provided many viable options to approach these reconstructions. The pedicled anterolateral thigh (ALT) flap has been reported as such an option. However, the relative paucity of such reports in the literature requires further research to elucidate its place in abdominal wall reconstruction. In this study we present our experience with the pedicled ALT flap, a review and analysis of the literature, and an examination of its role in abdominal wall reconstruction.

Methods: We performed a retrospective chart review looking at 6 patients in whom a pedicled ALT flap was used to reconstruct an abdominal defect between August 2009 and August 2012 at one institution. In addition, a Medline search was performed to find similar cases. An analysis was then performed on data from 10 articles, revealing complication rates and appropriate surgical technique.

Results: In addition to our 6 cases, our search of the literature revealed 39 cases in which a pedicled ALT flap was used to reconstruct an abdominal defect. The largest single flap reported was 27x24cm. From our series, we report a case of bilateral pedicled ALT flaps combining for a dimension of 29x28cm. Most flaps were used to reconstruct defects of the lower abdomen; however, 11 flaps reached above the umbilicus, with 4 extending into the epigastric region. There was a 4.4% (n=2) total flap loss rate, one due to pedicle avulsion and one to atherosclerotic plaque embolization. 20% (n=9) of cases experienced wound-healing problems, 44.4% (n=4) of which were in patients that had undergone prior radiotherapy. 2 cases experienced donor site morbidity: one had leg pain and the other had rectus femoris necrosis causing leg weakness.

Conclusion: The pedicled ALT is a versatile flap with a wide arc of rotation that can be applied to many abdominal wall defects. Certain techniques can be used in order to gain greater pedicle length, such as tunneling the flap under the distal two-thirds of the rectus femoris muscle and the Sartorius muscle, division and repair of a nerve to vastus lateralis, ligation of various

vessels to dissect pedicle to higher order vasculature. Furthermore, the limits of the length of a flap can be pushed by using Spy technology with intraoperative fluorescence. Our experience, as well as published reports, verify that the pedicled ALT is a viable option, especially in the lower abdomen.

11:47am - 11:51am

Perineal Perforator Based Island Flaps for Perineal Reconstruction

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Youn¹; (1)Hanyang University Medical Center, (2)Tan Tock Seng Hospital

Institution where the work was prepared: Jeong Tae Kim, Seoul, , South Korea

Introduction Perineal reconstruction is a challenging prospect, often occurring after tumour extirpation, trauma or severe infection. Conventional flap reconstruction often involves the sacrifice of a source artery and muscle, resulting in a significant donor morbidity, and the bulky flap reconstruction may cause aesthetic and functional problems. In this paper, we introduce the use of perforator based island flaps in perineal reconstruction, which has the advantage of a sufficient arc of rotation and primary closure of the donor site. This concept of a perforator based island flap is founded on the basis of the perineum being one of the perforator-rich areas in the body, where intraoperative perforator identification and tedious dissection is not required, as opposed to perforator-reliable and perforator-poor regions. This thus allows the flap to be harvested easily in an islanded manner, and subsequently rotated into the defect due to the large arc of rotation afforded.

Patients and Methods Eleven patients who had moderate-sized perineal defects underwent reconstruction with perineal perforator based island flaps(PBIFs). Aetiologies resulting in the perineal wounds included extra-mammary Paget's disease of the vulva, vulval squamous cell carcinoma and pseudohermaphroditism. The perineal PBIF is designed based on perforators near the defect, placing the flap incisions along the inguinal and gluteal fold lines, which allows for later primary closure of donor site. As there are plenty of reliable perforators in the perineal area, the PBIF is simply elevated and transferred with once a sufficient arc of rotation is achieved. Primary closure of the donor site is the main focus of this technique due to the high density of perforators. After initial donor closure, the flap easily reaches the defect as the perforator is selected near it.

Results All PBIFs survived, with no complications. All donor sites were closed primarily, which was aesthetically satisfactory. The dimension of the perineal PBIF was also enough to resurface the large perineal defects.

Conclusion PBIF, one of the most successful outcomes of the perforator concept, represent an exciting new weapon in the armamentarium of the reconstructive surgeon, when faced with difficult perineal wounds in challenging patients. They allow for a free-style elevation of the perforator flap without the need for perforator identification in the perforator-rich area

of the perineum, do not require the sacrifice of donor vessels or muscle, and allow for primary closure of the donor site, resulting in minimal donor morbidity with an excellent aesthetic outcome.

11:51am - 11:55am

Distal IMAP And SEAP Flaps for The Treatment of Keloids in Lower Sternal And Upper Abdominal Areas

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Institution where the work was prepared: Shanghai Ninth People's Hospital, Shanghai JiaoTong University, Shanghai, , China

ABSTRACT

Background: Keloids that cause unacceptable disfigurement to the affected individuals often require surgical excision with a tension-free closure. This paper reports the clinical application of pedicle propeller flaps based on the 6th internal mammary artery perforators (IMAP) and on the superior epigastric artery perforators (SEAP) for the treatment of large lower sternal and upper abdominal keloids. Perforator selection and flap design were based solely on preoperative multidetector-row computed tomography angiography (MDCTA) of the areas adjacent to soft tissue defects.

Methods: Between January 2011 and July 2012, 10 patients underwent keloid excision. The location of the defects included the upper abdomen (n=4) and lower sternum (n=6). The intraoperative perforator location was compared to MDCTA imaging.

Results: Ten patients underwent keloid removal followed by IMAP (n=6) and SEAP (n=5) flap coverage. Flap sizes ranged from 9 x 5 cm to 17 x 6 cm (average, 13 x 5 cm). Only 1 IMAP flap had a 2 x 2 cm tip necrosis that was managed with dressing changes, whereas the remaining patients healed uneventfully with no keloid recurrence at 6 months. In all cases, the exact location of the perforators obtained by preoperative MDCTA was consistent with the intraoperative findings.

Conclusion: Our clinical experience demonstrated that the 6th IMAP and SEAP flaps provide a valid and feasible approach for the reconstruction of defects located in the lower sternal and upper abdominal areas. MDCTA imaging allowed for detailed preoperative assessment of the perforators that eased both flap design and dissection and saved operating time.

12:03pm - 12:07pm

The Bone-In Fillet Flap: A Spare-Parts Approach to Achieving Simultaneous Bony Pelvic Stabilization and Soft Tissue Reconstruction Following External Hemipelvectomy

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Institution where the work was prepared: Massachusetts General Hospital/Harvard Medical School, Boston, MA, USA

Background: "Spare-parts" approaches to soft tissue reconstruction following external hemipelvectomy have been well described. Little attention, however, has been devoted to application of these methods for bony pelvic reconstruction. Bony stabilization of the pelvis following external hemipelvectomy facilitates upright sitting, prevents pelvic viscera herniation, and enables stable side-side transfers into and out of bed, each of which is critical to quality of life.

Case Example: A 16 year-old boy presented to our institution with a large, ill-defined osteolytic mass obliterating the right hemipelvis with extension into the proximal femur. A biopsy revealed grade 2 osteosarcoma. After neoadjuvant chemotherapy, external hemipelvectomy (hind-quarter amputation) was performed. While the external hemipelvectomy was being performed, we simultaneously harvested a chimeric lower extremity free fillet flap containing both tibia and overlying soft tissue (Figure 1). The flap was then brought up to the pelvis (Figure 2) and the tibia fixated proximally to the sacrum and distally to the symphysis pubis (Figure 3). The external iliac artery and the inferior vena cava were chosen as recipient vessels. A handsewn end-to-side anastomosis of the vena cava, and end-to-end anastomosis of the artery were performed (Figure 4). The patient did well post-operatively. Beginning at 1-month following the procedure the patient was able to transfer into and out of bed, and began to sit upright (Figure 5).

Conclusions: We introduce the Bone-In Fillet flap for simultaneous pelvic stabilization and soft tissue reconstruction following external hemipelvectomy. Unique to this flap is the incorporation of tibial bone for pelvic ring reconstruction with fixation between the sacrum and pubic symphysis deep to the fillet flap, creating the Bone-In Fillet organization. This critical step restores the stabilizing and weight bearing effect of the resected hemipelvis to permit upright sitting and stable transfers. We advocate the Bone-In Fillet flap for its ease of use, application of spare parts

techniques, and potential to significantly improve patient quality of life following external hemipelvectomy.



Figure 1: Hind-quarter amputation demonstrating dissection of the tibia and surrounding soft tissue.



Figure 2: Chimeric lower extremity free fillet flap containing both tibia and overlying soft tissue



Figure 3: The tibia was fixated proximally to the sacrum and distally to the symphysis pubis.



Figure 4: Bone-In Fillet Flap after handsewn end-to-side anastomosis of the vena cava, and end-to-end anastomosis of the external iliac artery



Figure 5: Flap was inset, providing bony stabilization and soft tissue coverage following external hemipelvectomy

12:07am – 12:11am

Reconstruction for the Whole Esophagus and Voice Function with A Pedicled Ileocolon Flap for Patients with Simultaneous Esophageal and Hypopharyngeal Cancers

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Institution where the work was prepared: China Medical University Hospital, Taichung, , Taiwan

BACKGROUND: Because of the development of endoscope there are more and more patients who had early detection of simultaneous esophageal cancer and hypopharyngeal cancer. They undergo chemoradiation, esophagectomy and total pharyngolaryngectomy by chest surgeons and ENT doctors. However, their swallowing and voice function need to be reconstructed by plastic surgeons.

METHODS: From 2004 to 2013 11 patients were treated with a pedicled ileocolon flap which included terminal 10 cm of ileum, ascending colon and part of transverse colon. The vascular pedicle was left ascending colic artery and its accompanying vein. In 8 among the 11 patients microvascular anastomoses of vessels were done at the rt neck for supercharge to ensure good survival of the pedicled flap. The long pedicled colon segment was used for reconstruction of whole esophagus including pharynx, and the ileum segment was used for voice reconstruction.

RESULTS: There was no failure or partial loss in the flaps of these patients. One patient had leakage at the junction of pharynx and colon, which was repaired one month later. The swallowing function was restored in these patients. Nine patients had restoration of good speech function, the other 2 had voice but only understood by his family due to weakness after chemoradiation and hypothyroidism.

CONCLUSION: This is a good option for reconstruction of swallowing and speech in patients who had simultaneous esophagectomy and total pharyngolaryngectomy. The inset of the voice tube has been improved to warrant this procedure.