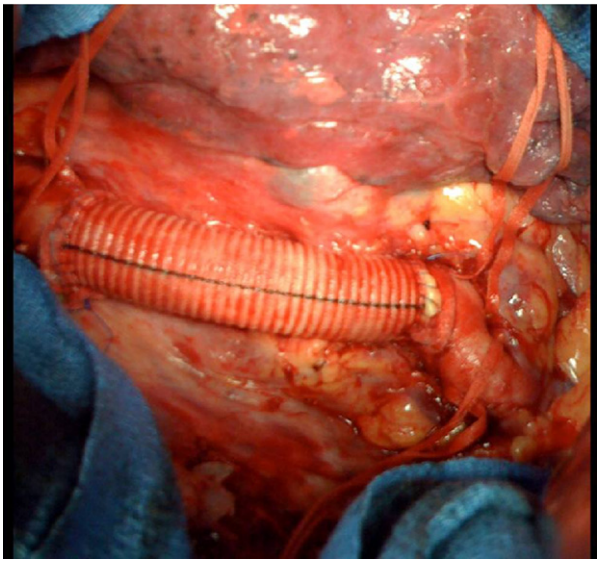

Fig 2. An interposition Dacron graft was used to repair the coarctation.

from the subclavian to the internal mammary arteries and through the epigastric vessels into the common femoral arteries bilaterally. An endovascular management of the coarctation was deemed not safe due to the small size of the thoracic aorta (17 mm), small common iliac vessels (6 mm), and severe angulation of the thoracic aorta at the coarctation.

Results: Repair was done thru a left posterolateral thoracotomy in the third rib interspace. After the inferior pulmonary ligament was divided, control was obtained in the aortic arch between the left carotid and subclavian arteries, at the left subclavian artery, and in the midthoracic aorta. Because the patient had developed such a large chest due to the abdominal wall collaterals, no adjunctive bypass procedure was used. Ligation of the large intercostals in the area of the coarctation was necessary for complete vascular control; an interposition 16-mm Dacron graft was used for the repair (Fig 2). The patient's postoperative recovery was unremarkable.

Conclusions: Interposition graft repair of thoracic aortic coarctation helps avoid tension that would be present in an end-to-end anastomosis and is safe to perform in the adult patient without adjunctive bypass. As vascular surgeons become more facile with endovascular treatment of thoracic aortic aneurysmal disease, certain advantages of open repair for this rare thoracic aortic pathology may assume more importance in the future. Endovascular management with balloon dilatation, with or without a covered self-expanding stent, may palliate the hypertension but is limited in many cases by anatomic constraints and late recurrence; its greatest advantage may be in the treatment of recurrent stenosis or late, large aneurysm formation.

Hormone Replacement Therapy Influences Intimal Hyperplasia after Vascular Injury: Role of Matrix Metalloproteinases

James E. Chalk, Deidra J. H. Mountain, Stacy S. Kirkpatrick, David C. Cassada, Scott L. Stevens, Michael B. Freeman, Mitchell H. Goldman, and Oscar H. Grandas, From the University of Tennessee Graduate School of Medicine. Knoxville, Tenn

Objective: Postmenopausal women taking hormone replacement therapy (HRT) require a secondary intervention after vascular reconstruction due to increased intimal hyperplasia (IH) more often than women not taking HRT. Matrix metalloproteinases (MMPs) affect IH by degradation of components of the basement membrane, allowing excess vascular smooth muscle cell (VSMC) migration and proliferation. The MMP pathway is regulated by a balance between MMPs, membrane type-MMPs (MT-MMPs), and tissue inhibitor of MMPs (TIMPs), and we have recently provided evidence for unbalanced regulation of this pathway in VSMCs exposed to hormones in vitro. Here we studied the role of HRT in the modulation of this regulatory pathway in vivo and on the development of IH in a postmenopausal rodent model of vascular injury.

Methods: Female rats aged to 12 months underwent ovariectomy. Hormones or placebo were delivered 4 weeks later through a 90-day slow-release pellet. After 6 weeks of HRT, each rat underwent balloon angioplasty of the left common carotid artery. At 14 days after injury, tissue samples were collected and stained with trichrome elastin and for isoform-specific MMPs.

Results: Ovariectomy in the placebo group reduced I/M ratios to 0.94 ± 0.03 compared with 1.25 ± 0.26 in non-ovariectomy controls (n = 3). After ovariectomy, estrogen replacement alone had very little effect (1.07 ± 0.17) compared with placebo, whereas progesterone alone and in combination with estrogen increased I/M ratios to 1.26 ± 0.05 and 1.16 ± 0.21, respectively. Intimal expression of MMP-2 and −9 after injury dropped in response to ovariectomy and was increased by HRT (Table; n = 2 to 3).

Table 1	% intima stained			
	NonOVX C	OVX - Plac	OVX - E	OVX - EP
MMP-2	37.8±10.0	18.0±4.5	21.0±1.5	25.9±4.2
MMP-9	4.3±0.1	2.4±0.3	4.5±1.1	10.0±2.2
TIMP-2	50.9±8.9	48.2±23.1	10.0±1.1	46.5±5.7
MT1-MMP	52.0±10.1	65.3	57.1±0.3	74.2±5.1

Conversely, estrogen resulted in a fivefold decrease in TIMP-2 compared with placebo (Table; n = 2 to 3). At 14 days after injury, there was no effect on intimal MT1-MMP in any group. In a time course study of IH development, we have previously shown MT1-MMP is highest at day 2, and then decreases significantly. Assays at earlier times are needed in hormone groups to examine the role of HRT in the possible exacerbation of this early peak.

Conclusion: Ovariectomy may result in decreased IH development, contrary to the theory that endogenous hormones are protective against vascular disease. Furthermore, we show progesterone alone and combined with estrogen may increase IH, consistent with the theory that HRT has a deleterious affect in vascular pathology. Larger study groups are needed to delineate the actual role of HRT as a modulator of IH in vivo. We previously reported that hormone exposure results in unbalanced MMP regulation in vitro. Here we demonstrate HRT modulates the MMP regulatory pathway in vivo, specifically by the upregulation of MMP-2 and −9 without a counter-regulatory increase in TIMPs. This unbalanced regulation may be a key factor in increased IH development seen with HRT. In future studies, in vivo manipulation of this unbalanced MMP regulation for prevention of IH should be examined, and timing of HRT initiation with respect to vascular injury should be addressed.

Calf Study to Examine Endostaple-Related Thrombogenesis and Tissue In-Growth

Hugh H. Trout III, and Howard M. Tanner, From Suburban Hospital. Bethesda, Md

Background: To achieve secure attachment of a prosthetic graft to an artery, it is well established that the prosthetic graft be attached to the full thickness of the arterial wall. Most commercially available endografts rely on friction and columnar noncompressibility to provide endograft attachment to the aortic neck just below the renal arteries. Although this approach works in many instances, there is still a 4% per year complication rate that requires reintervention as well as a 1% aneurysm rupture rate. Moreover, proximal type I endoleak remains a concern. This study assessed the ability of Endostaples to attach a patch graft to the thoracic aorta of calves.

Methods: To assess tissue ingrowth into the Endostaple and any thrombus formation after insertion into an aortic wall, an arterial prosthetic graft was attached in a patch fashion to an oval opening in the descending aorta in 11 calves. Two-thirds of the suture line was achieved using 5-0 polypropylene sutures and one-third of a contiguous segment was achieved solely with Endostaples inserted using a holmium yttrium aluminium garnet laser in each calf. Seven calves were sacrificed at 30 days and four at 90 days. Histopathologic examination was performed on all 11 specimens.

Results: Histopathologic examination demonstrated excellent tissue ingrowth into and throughout all Endostaples. There was no residual thrombus on the graft suture line or the Endostaple line. The inflammatory changes observed, typical of a healing graft/arterial attachment, elicited by the Endostaple line were equal or less than those observed by the suture line. No observable differences were noted between the 1- and the 3-month animals and between those with one row of Endostaples inserted and those with a double row (to determine if the Endostaples might cause tissue necrosis if many were placed close together). No Endostaple failed to hold the graft to the aortic wall, and there was no evidence of any separation of the prosthetic graft from the aortic wall. All of the 92 tested Endostaples had complete tissue ingrowth into the interstices of the Endostaple (markedly reducing the ability of the staple wire to be subjected to flex forces).

Conclusions: A coiled coil Endostaple appears to be equivalent to standard vascular suture in attaching prosthetic material to the full thickness of the thoracic aorta in calves. This appears to have considerable promise in

improving endograft attachment. Moreover, it is likely that enhanced attachment will provide an opportunity for improved endograft design.

Saphenous Vein Viability: A Comparative Study between Two Surgical Specialties Harvesting Human Saphenous Vein with a Porcine Saphenous Vein Model Emulating Intraoperative Mechanical Stress

Syed Z. Rizvi, Kyle M. Hocking, Padmini Komalavilas, Gowthani Putumbaka, Raul Guzman, Jeffrey Dattilo, Colleen M. Brophy, and Thomas Naslund, From Vanderbilt University. Nashvillle, Tenn

Background: Human saphenous vein (HSV) is the autologous conduit used most commonly for coronary artery bypass grafting (CABG) and peripheral vascular (PV) reconstructions. Despite the shorter length of conduit and higher flow in CABG, numerous reports suggest that patency rates are higher in PV reconstructions. This study was performed to determine the viability of the smooth muscle in HSVs harvested for CABG and PV between two surgical specialties. We further used porcine saphenous veins (PSVs) to assess the effect of radial and longitudinal stress to model intraoperative mechanical handling of HSV.

Methods: Remnants of HSVs were collected in University of Wisconsin preservation solution and stored at 4°C. Rings were cut to 1-mm thickness. Lengths and weights were measured before suspension in a muscle bath where they were equilibrated in bicarbonate solution at 37°C. HSV rings were then exposed to potassium chloride (KCl, 110mM) to depolarize and contract the vascular smooth muscle, and the amount of force generated over basal force was determined (Δg). Force was converted to stress (N/m^2) to adjust for varying lengths and weights. PSVs were similarly preserved. These were divided into two groups; each group endured either radial or longitudinal stress. Before application of the stressor, a portion of each individual vein was preserved as a control. To determine if mechanical trauma alters tissue viability, PSVs were subjected to radial stress by manual distension (>300 mm Hg). Longitudinal stress was applied by the manual stretch method, which involved taking a sample of vein, clamping the two ends, and stretching the vein to 200% its original size. PSV rings were then similarly prepared for muscle bath suspension and KCl challenge to calculate force and stress.

Results: HSVs harvested for PV produced significantly greater force (3.75 ± 0.8566 g) than HSVs harvested for CABG (0.8466 ± 0.1809 g, Fig 1). When adjusted for tissue mass and length, HSVs harvested for PV ($0.1192 \pm 0.02776\ 10^5\ N/m^2$) also produced significantly greater stress than HSV harvested for CABG ($0.04198 \pm 0.008128\ 10^5\ N/m^2$, Fig 2). Manual distension did not alter the smooth muscle responses of PSVs (Fig 3). Longitudinal stress significantly decreased the force of PSVs (Fig 4).

Conclusions: These data suggest that longitudinal mechanical stress during harvest, as seen with minimally invasive or endoscopic harvesting techniques, may affect functional viability of HSV smooth muscle. Manual distension did not appear to affect PSV viability. Because injury is one of the inciting events leading to intimal hyperplasia, avoiding longitudinal stress during harvest and preparation may improve patency of arterial bypass using HSV.

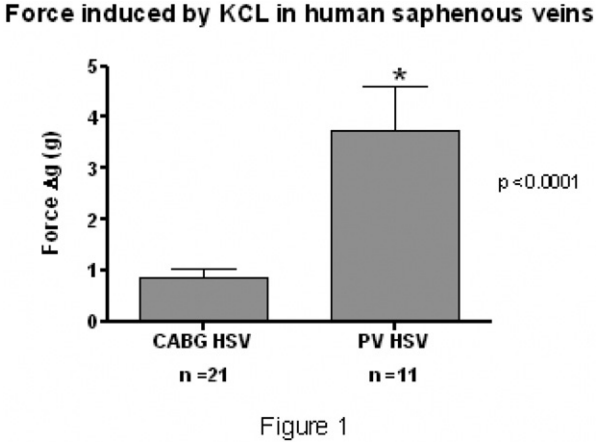

Fig 1. Force induced by potassium chloride in human saphenous vein *(HSV)*. *CABG,* Coronary artery bypass grafting; *PV,* peripheral vascular.

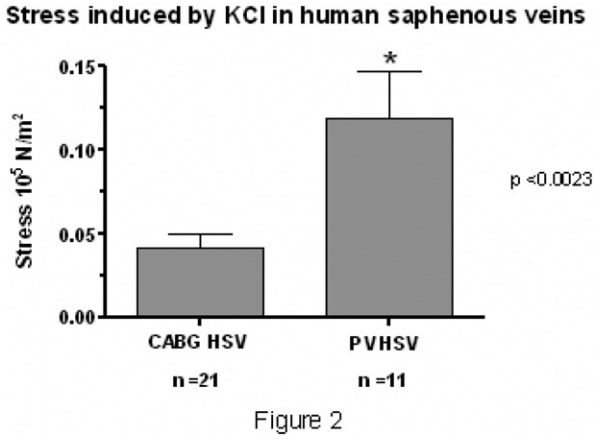

Fig 2. Stress induced by potassium chloride in human saphenous vein *(HSV)*. *CABG,* Coronary artery bypass grafting; *PV,* peripheral vascular.

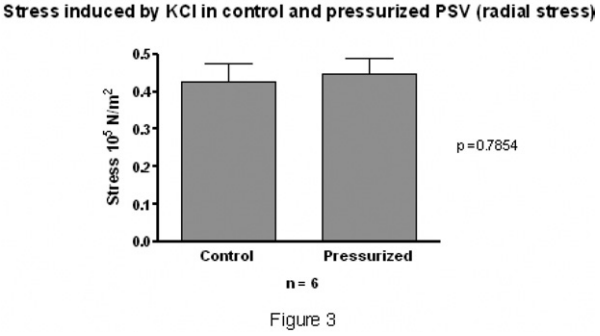

Fig 3. Radial stress induced by potassium chloride in control and pressurized pork saphenous vein *(PSV)*.

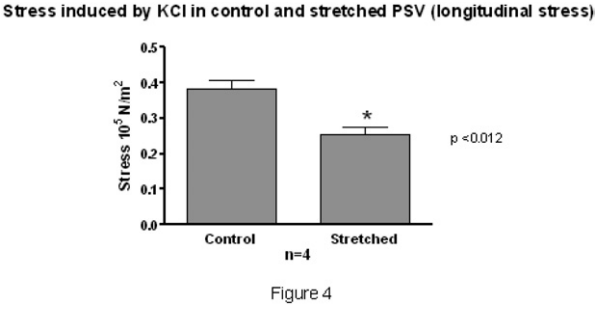

Fig 4. Longitudinal stress induced by potassium chloride in control and stretched pork saphenous vein *(PSV)*.

Therapeutic Distant Organ Effects of Regional Hypothermia during Mesenteric Ischemia-Reperfusion Injury

Rachel J. Santora,[1] Mihaela L. Lie,[2] Dmitry N. Grigoryev,[2] Omer Nasir,[2] Frederick A. Moore,[1] and Heitham T. Hassoun,[1] From The Methodist Hospital Research Institute, Houston, Tex[1]; and Johns Hopkins University, Baltimore, Md.[2] Houston, Tex; Baltimore, Md

Background: Mesenteric ischemia/reperfusion injury (IRI) occurs in various clinical settings, including shock, sepsis, and aortic surgery. Therapeutic hypothermia is cytoprotective in various IRI models; however, little is known about the effects of regional hypothermia on distant organ dysfunc-