Presentation Number: 31

Publishing Title: Comparison of a Vascular Study Group of New England (VSGNE) Risk Prediction Model With the Established Risk Prediction Models of In-Hospital Mortality After Elective Abdominal Aortic Aneurysm (AAA) Repair

Author Block: **Mohammad H. Eslami, MD**[1], Denis Rybin, PhD[2], Gheorghe Doros, PhD[2], Jeffrey Kalish, MD[1], Alik Farber, MD[1].
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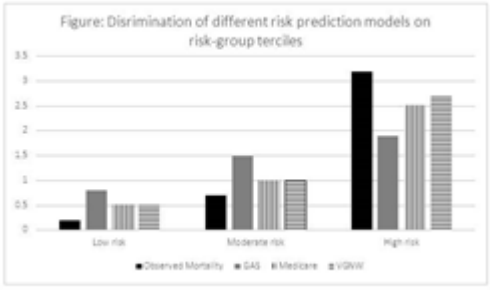
Abstract Body:
INTRODUCTION: Elective AAA repair can lead to in-hospital mortality, but no agreement exists on the most accurate predictive model for in-hospital mortality. The purpose of this study was to develop a risk prediction model using VSGNE data and compare that to established models.
METHODS: VSGNE data (2003-2013) was queried for patients undergoing elective AAA repair by open (OAR) or endovascular (EVAR) techniques. Clinical variables including known predictors of mortality were included in a full prediction model. Backward elimination with alpha-level of 0.5 was used to construct a parsimonious model. This model (VSGNE) was then compared to established models based on the scope of VSGNE data collection: Medicare, Glasgow Aneurysm Score (GAS) and Vascular Governance North West (VGNW). Vuong test was performed to compare the fit of models. Model discrimination was compared in equally-sized risk-group VSGNE terciles.
RESULTS: The overall mortality rate for 4597 elective AAA patients was 1.5%, with a significantly higher mortality rate for OAR (2.7% vs. 0.7%, p<.001). Table below shows the parsimonious model. The discriminating ability of the VSGNE model was high(C-statistic=0.812) and corrected slightly to 0.782 after internal validation. Vuong tests yielded significant overall fit difference favoring VSGNE model over all three models and Medicare(C-statistic 0.761) and VGNW (0.760) to GAS (0.681). VGNW and Medicare models performed better than GAS in predicting mortality among risk-group terciles (Figure).
CONCLUSION: The VSGNE risk prediction model forecasts mortality the best among this patient population. Both Medicare and VGNW models showed good discrimination.
Table: In-hospital Mortality after Elective AAA: Parsimonious 0.5 level (C=0.812)

	Adj. Odds Ratio	Lower Confidence Limit	Upper Confidence Limit	p value
Open Infrarenal/Above One Renal Clamp vs. Endo	3.8700	2.0485	7.3112	<0.0001
Open Above Both Renals/Supraceliac Clamp vs. Endo	8.6776	4.3051	17.4910	<0.0001
Age	1.0790	1.0368	1.1228	0.0002
Female vs. Male	1.7280	1.0023	2.9794	0.0491
BMI	0.9749	0.9260	1.0264	0.3337
Current Smoking: Yes vs. No	0.6942	0.3065	1.5720	0.3814
Myocardial Disease	1.7219	1.0019	2.9593	0.0492
CVD	2.0902	0.9933	4.3984	0.0521
CHF	1.7298	0.8520	3.5122	0.1294
COPD	2.4737	1.4262	4.2905	0.0013
Creatinine	1.3210	0.9575	1.8225	0.09



Presentation Number: 32

Publishing Title: Long term Surveillance of EVAR Patients with Ultrasound is Safe and Effective.

Author Block: **William C. Wu, MD**, Raymond Eid, MD, Robert Hacker, MD, Michel S. Makaroun, MD, Rabih A. Chaer, MD.
University of Pittsburgh Medical Center, Pittsburgh, PA

Abstract Body:
OBJECTIVES: Color flow duplex ultrasound (CDU) surveillance is an accepted alternative to computed tomography (CT) following endovascular repair of abdominal aortic aneurysms (EVAR). However, the long term effectiveness and safety of yearly ultrasound-only surveillance is not yet well defined. The purpose of this study was to evaluate the safety and effectiveness of CDU follow-up in the long term.

METHODS: Patients who underwent EVAR between January 1, 2005 and December 31, 2010, with no routine CT after 1 year and followed with CDU as the primary surveillance method for at least 2 years, were included. Subsequent CT scans were only selectively obtained for enlarging sac size or suspected type I or III endoleak. The majority of type II endoleaks were followed with CDU only.

RESULTS: 169 patients switched to CDU follow-up no later than 1 year after EVAR and followed for 2 to 8 years, with a mean of 4.5 +/- 1.3 years (53.6 +/- 16.1 months) were reviewed. They included 2 patients with limb infolding treated with extra stent grafts and 26 patients with known prior endoleaks detected during the first year, with 2 Type IB and 1 Type II already treated. During CDU follow-up, 27 patients were identified to have a new endoleak, 7 of whom required a total of 8 re-interventions with endovascular stent graft extension or coiling, 4 after a confirmatory CT and 4 without. One patient with a renal artery stenosis at 3 years underwent angiography and was found to have a renal artery occlusion caused by a barb fracture and migration without endoleak. Only 6 patients underwent a CT to further evaluate findings on CDU.
There were no ruptures, limb occlusions, or AAA-related deaths throughout the period of follow-up.

CONCLUSIONS: After the 1 year postop CT, a switch to CDU as the primary means of follow-up is a safe and effective surveillance strategy after EVAR.

Presentation Number: 33

Publishing Title: **Comparative Safety of Endovascular and Open Surgical Repair of Abdominal Aortic Aneurysms in Low-Risk Patients**

Author Block: **Jeffrey J. Siracuse, MD**, Heather L. Gill, MD, Ashley R. Graham, Darren B. Schneider, MD, Peter H. Connolly, MD, Art Sedrakyan, MD, Ph.D., Andrew J. Meltzer, MD
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Abstract Body:
OBJECTIVES: The prevalence of significant co-morbidities among patients with abdominal aortic aneurysms (AAA) has contributed to widespread enthusiasm for endovascular AAA repair (EVAR). However, the advantages of EVAR in patients at low risk for open surgical repair (OSR) remain unclear. Our objective is to compare perioperative outcomes of EVAR to OSR in low-risk patients.
METHODS: Patients undergoing EVAR and OSR for infrarenal AAA were identified in the 2007-2010 National Surgical Quality Improvement Program datasets. AAA-specific risk stratification, using the Medicare Aneurysm Score (MAS), was used to create matched low-risk (MAS<3) cohorts. Perioperative morbidity and mortality were assessed via crude comparisons of matched groups and regression models.
RESULTS: Of 11753 patients undergoing EVAR, 4339 (37%) were deemed low risk (MAS<3). A matched cohort of 1576 low risk patients was developed from 3804 (41%) undergoing OSR. By definition, the low-risk cohorts included only males aged <75 without significant cardiac, pulmonary, or vascular co-morbidities. Mean age in both low risk groups was 67+/-6 years (P=NS). EVAR patients were more likely to be obese (40.8% vs. 30.4%, P<.001), diabetic (16.2% vs. 13.1%, p=.005), and have a history of cardiac intervention (24.3% vs. 19.2%, P<.001), and/or surgery (22.6% vs. 19.7%, p=.02), steroid use (3.6% vs. 2.0%, p=.002), and bleeding disorders (8.7% vs. 5.9%, p=.001). There were no other differences between the matched cohorts. EVAR was associated with reduced 30-day mortality (0.6% vs. 1.5%, p<0.01), and reduced rates of major complications including: sepsis (0.7% vs. 3.2%, p<0.01), unplanned intubation (1.0 vs. 5.4%, p<.001), pneumonia (0.8% vs. 6.1%, p<.001), acute renal failure (0.4% vs. 2.7%, p<.001), and early reoperation (3.7% vs. 6.0%, p 4 units (2.0% vs. 13.0%, p<.001), cardiac arrest (0.2 vs. 0.8, p=.001), neurological deficits (0.2% vs. 0.5%, p=.032), and urinary tracts infections (1.2% vs. 2%, p=.02).
CONCLUSION: Our results demonstrate that even among those patients at low risk for OSR, EVAR is associated with reduced perioperative mortality and major complications. While clinical decisions must account for safety and long-term effectiveness, the short-term benefit of EVAR is evident even among patients at the lowest risk for OSR.

Presentation Number: MP33

Publishing Title: Is EVAR Surveillance Necessary For The First Three Years Following An Initially Normal Duplex Post-Operative Study?

Author Block: **Douglas A. Troutman, DO**, Mohammed Chaudry, MD, Matthew J. Dougherty, MD, Keith D. Calligaro, MD.
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Abstract Body:
OBJECTIVE: We have previously shown that duplex ultrasonography (DU) may replace computed tomographic angiogram (CT-A) as the primary surveillance tool for endovascular aortic aneurysm repair (EVAR). Current Society for Vascular Surgery practice guidelines suggest that if CT-A does not document endoleak, aneurysm sac enlargement, or limb stenosis at 1 and 12 months post-EVAR, surveillance studies may be performed annually. The purpose of this study is to determine whether the time to the second surveillance DU study can be safely postponed to 3 years post-EVAR if the initial study is normal.
METHODS: Between 1998-2013, DU surveillance was performed in our accredited non-invasive vascular laboratory at 1 week, 6 months, and annually after 410 EVARs (follow-up: mean, 35 months; range, 1-151 months). DU measured sac diameter, intrasac endoleak peak systolic velocities (PSVs), and PSVs within the endograft limbs. If endoleak, limb stenosis/kinking, or increase in sac size was documented, DU surveillance was performed more frequently or CT-A and possible intervention were performed.
RESULTS: Based on DU surveillance, 113 (27%) patients were diagnosed as having either endoleak [95 (23%) patients with 118 endoleaks: 15 (13%) Type I, 90 (76%) Type II, 11 (9%) Type III, 2 (2%) Type IV] or graft limb stenosis [18 (4%) patients, based on PSV >300 cm/s] during the follow-up period. Intervention was performed in 33% (37) of the 113 patients with endoleak or limb stenosis, or in 9% (37/410) of the total group, during the follow-up period of 1-151 months. Only 2.2% (7/325) of patients with an initial normal post-EVAR DU went on to develop endoleak or limb stenosis/kinking that required intervention during 3 year follow-up vs. 25% (21/85) of patients with an initial abnormal post-EVAR DU ($p = 0.0001$).
CONCLUSION: These findings suggest that follow-up DU surveillance can be postponed until 3 years post-EVAR if the initial surveillance DU is normal (no endoleak, sac enlargement, stenosis, or kinking) with minimal risk of an adverse clinical event.

Presentation Number: MP34

Publishing Title: **Type 2 Endoleak Following EVAR is Associated with Aneurysm Expansion Without a Negative Impact on Survival**

Author Block: **John B. Luke, III, MD**, Zdenek Novak, MD, Mark A. Patterson, MD, Marc A. Passman, MD, Thomas C. Matthews, MD, Benjamin J. Pearce, MD, William D. Jordan, Jr., MD.
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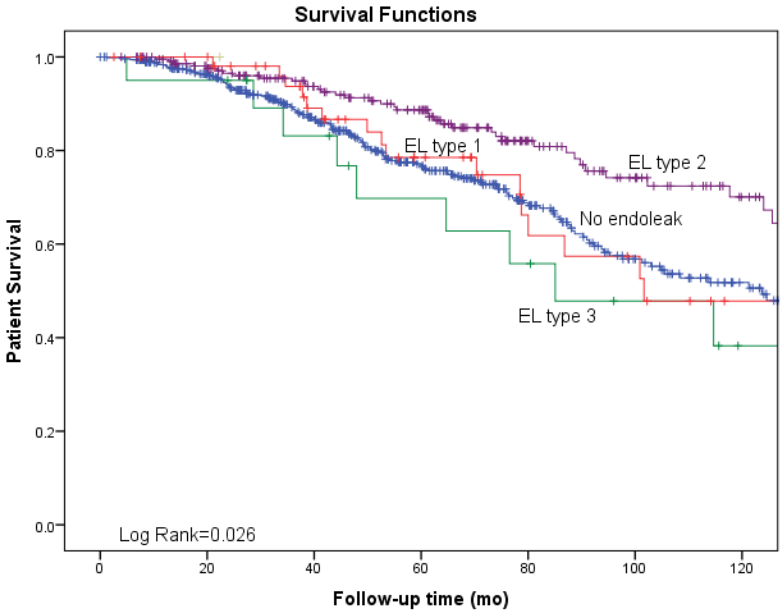
Abstract Body:

OBJECTIVES: Abdominal aortic aneurysm (AAA) sac behavior following endovascular aneurysm repair (EVAR) is a dynamic process that mandates long term surveillance. This study evaluates predictors for aneurysm sac growth and post EVAR survival to define the impact of endoleak on overall patient survival.

METHODS: All EVARs performed in a single institution with at least 6 month imaging follow up between 1999-2013 were identified from a prospectively maintained registry. Review of medical records and imaging was performed. Patient groups were stratified by endoleak type. Cox regression, Chi squared test, and Kaplan-Meier analysis was performed comparing medical co-morbidities to sac growth and overall patient survival.

RESULTS: Of 800 patients, 296 (37.0%) exhibited endoleak during at least one encounter during their post EVAR surveillance. More specifically, 219 patients (27.3%) exhibited type 2 endoleak (T2EL). Of those with T2EL, 27(3.3%) showed evidence of sac growth > 5mm. Additionally, 21(77.8%) patients with T2EL required at least one re-intervention due to sac expansion. Patients with T2EL were found to demonstrate similar sac behavior when compared to those without endoleak with 5 year surveillance. As surveillance approached 10 years, those with T2EL revealed a roughly 19% greater incidence for significant sac growth when matched to those without endoleak. Hypertension and endoleak were significantly associated with sac growth >5mm ($p=0.013$, OR 1.9 and $p<0.001$, OR 4.6 respectively). Presence of T2EL during surveillance was not associated with worsened overall survival (Figure 1).

CONCLUSIONS: Post EVAR endoleak and hypertension significantly affect aneurysm sac behavior. Although associated with AAA sac growth, T2El does not confer a negative impact on post EVAR long term patient survival.



Presentation Number: MP35

Publishing Title: Does iliac artery aneurysm increase secondary intervention rates after EVAR?

Author Block: **Mohsen Bannazadeh**, Christina Jenkins, Andrew Forsyth, Jason Kramer, Paul Bove, Ankur Aggarwal, Graham Long.
Beaumont Hospital, Royal oak, MI, USA.

Abstract Body:
OBJECTIVES: The purpose of this study was to evaluate the morbidity from common iliac artery aneurysm (CIA) after endovascular aortic aneurysm repair (EVAR).
METHODS: This is a retrospective review of all patients who underwent elective EVAR from June 2006 through June 2012 at a single institution. Patient demographics, hospital course, radiographic imagings, and follow-up visits were analyzed. Patients with CIA were treated with either flared endograft limb (FL; iliac limb >20 mm) or CIA exclusion (CIAE) with endograft limb extension into the external iliac artery. Outcomes between these groups were compared using $\chi 2$ tests and the Kaplan-Meier method with Log-rank tests.
RESULTS: Of 627 patients who underwent elective EVAR during this period, 422 underwent standard EVAR with endograft limb <20 mm (group A), 143 were treated with FL (group B), 38 had CIAE (group C), and 24 were managed with a combination of FL in one limb and CIAE in the other (group D). There was no difference in secondary intervention rate between groups (group A= 13%; group B= 9.1%; group C= 15.8%; group D= 16.7%; p=0.47). Similarly, no difference was noted in major complication (endoleak, thrombosis, rupture, endograft infection) rates amongst the groups (p = 0.38). Overall perioperative mortality was 1.45 %. The average iliac growth rate was 2.2 ± 4.7 mm per year despite intervention with FL or CIAE. Overall median survival was 103 months (interquartile range, 92-115 months) with no difference between the groups (p=0.68). The median follow-up was 30 months.
CONCLUSIONS: Management of iliac artery aneurysm at the time of EVAR by flared limbs or external iliac extension does not increase the rates of secondary intervention or major complications.

Presentation Number: MP36

Publishing Title: Outcomes of Redo Aortobifemoral Bypass for Peripheral Arterial Occlusive Disease

Author Block: **Bradley Schmit, MD**, Salvatore Scali, MD, Robert Feezor, MD, Adam Beck, MD, Catherine Chang, MD, Alyson Waterman, MD, Scott Berceli, MD, Thomas Huber, MD
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Abstract Body:
OBJECTIVE: Patients presenting with occluded aortobifemoral bypass(ABF) grafts are managed with a variety of techniques. Redo ABF(rABF) procedures are infrequently performed due to concerns about procedural complexity and morbidity. The purpose of this analysis is to compare mid-term results of rABF to primary ABF(pABF) for occlusive disease to determine if there are significant differences in outcomes.
METHODS: Retrospective review was performed of all patients undergoing ABF for occlusive disease from 2002-2012. Nineteen rABF and 194 pABF cases occurred during that time period. Data for an indication and comorbidity-matched cohort of 19 elective pABF patients were collected for comparison to the rABF group. Primary end-points were 30-day and all-cause mortality. Secondary end-points were complication rates, amputation-free survival(AFS) and freedom from major adverse limb events(MALE).
RESULTS: rABF patients more frequently underwent prior extra-anatomic/lower extremity bypass operations compared to pABF(P=.02); however, no difference in prior failed iliac intervention(P=.4) was found. By design, indications for both rABF and pABF groups were the same: claudication, n=6/6(31.6%), P=1; critical limb ischemia, N= 13/13(78.4%), P=1. Aortic access was more frequently via retroperitoneal exposure in the rABF group(N=13 vs. N=1;P<.0001) and a significantly higher proportion of rABF patients required concomitant infrainguinal bypass or intra-procedural adjuncts such profundaplasty(N=14 vs. N=5;P=.01). Highlights of procedural differences are further depicted in the **Table**. Length of stay(days±SD) was similar (pABF, 11.2±10.4 vs. rABF, 9.1±4.5;P=.7) and no 30-day or in-hospital deaths occurred in either group. Similar rates of major complications occurred in the 2 groups[pABF, N=6 (31.6%) vs. rABF, N=4(21.1%)]; observed difference in rates, pABF-rABF=9.5%, 95% confidence interval (CI): -17.6-36.7%(P=.7).
Two-year survival(±standard error mean) was 91±9% and 90±9% for pABF and rABF patients(log-rank P=.8). Two-year AFS was 90±9% vs. 89±8% between pABF and rABF patients(log-rank, P=.5). Two-year freedom from MALE was 82±9% vs. 78±10% for pABF and rABF patients(log-rank, P=.6).
CONCLUSIONS: Patients undergoing rABF have higher procedural complexity as evidenced by greater operative time, blood loss and need for adjunctive procedures. However, similar perioperative morbidity, mortality and mid-term survival occurred in comparison to pABF patients. These results support a role for rABF in selected patients.

Table. Categorization of procedural variables and outcomes after aortobifemoral bypass[6]

Variable	*ABF(n=19)*	*Redo ABF(n=19)*	*p-value*
Aortic Access			
Retroperitoneal	1(5.3%)	13(68.4%)	
Transperitoneal	18(94.7%)	5(26.3%)	
Thorax	0	1(5.3%)	<.0001
Aortic anastomosis			
End to end	8(42.1%)	14(73.7%)	
End to side	11(57.9%)	5(26.3%)	.1
Aortic cross-clamp position			
Thorax	0	1(5.2%)	
Supra-celiac	0	2(10.5%)	
Supra-renal	6(31.6%)	6(31.6%)	
Infra-renal	13(68.4%)	10(52.6%)	.4
Cross-clamp time (min±SD)	24.7±7.9	22.8±5.0	.8
Renal ischemia (min±SD)	21.0±3.3	24.7±5.7	.2
Adjunct	5(26.3%)	14(73.7%)	.01
Lower extremity bypass	2(10.5%)	8(42.1%)	.06
Intraoperative details			
Estimated blood loss (mL±SD)	580±457	1097±983	.02
Intravenous fluid (mL±SD)	2279±993	3400±1422	.01
PRBC (units±SD)	1.0±1.2	2.2±2.0	.06
FFP (units±SD)	0.32±0.75	0.74±1.24	.3
Cell saver (mL±SD)	105±254	179±334	.4
Colloid (mL±SD)	289±356	500±441	.1
Procedure time(min±SD)	270±48	408±102	<.0001
Outcomes			
Length of stay (days±SD)	11.2±10.4	9.1±4.5	.7
30-day mortality	0	0	NA
Any complication	7(36.8%)	10(52.6%)	.5
Major complication	6(31.6%)	4(21.1%)	.7

[6]Mann-Whitney test for continuous variables and ordered categorical variables; Fischer's exact test for nominal categorical variables when appropriate

Presentation Number: MP37

Publishing Title: Value of Graft Surveillance After Open Aortic Operations

Author Block: **Rhusheet Patel, M.S.**, Sarah Wartman, MD, Fred Weaver, MD, Karen Woo, MD
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Abstract Body:
OBJECTIVES: To examine the late outcomes of open aortic operations and the value of routine post-operative surveillance duplex in identifying late graft-related complications.
METHODS: All open aortic operations performed at a single institution between 1998 and 2012 were retrospectively reviewed. All patients were scheduled for yearly post-operative surveillance duplex. Patients who had at least 30-day follow up and at least one surveillance duplex were analyzed.
RESULTS: 238 open aortic operations were performed during the study period, 140 of which met the inclusion criteria. Mean follow-up was 3.9 years. Mean age was 69 with 74% male. 111 (79%) had hypertension, 20 (14%) were diabetic and 38 (27%) had coronary artery disease. Chronic obstructive pulmonary disease (COPD) was present in 13 (9%) and 28 (20%) had a history of a previous aortic operation. The indication for operation was aortic aneurysm in 105 (75%), aortic dissection in 7 (5%) and occlusive disease in 28 (20%). A tube graft was performed in 65 (46%) and the proximal anastomosis was in the infra or juxta-renal position in 125 (90%). Overall survival at one year was 100% and 85.3% at five years. A mean of three surveillance duplexes was performed per patient. Sixteen (15%) patients required a graft- related operation at a mean of 2.4 years. Indications included: anastomotic aneurysm/pseudoaneurysm (6), limb occlusion (5), graft stenosis (2) and graft infection (1). The indication for operation was identified by surveillance duplex in four of the 16 cases. The remainder were identified by physical exam and/or clinical presentation. Re-intervention-free survival (RIFS) was 97.7% at one year and 77.4% at five years. On multivariable analysis, RIFS was decreased by a history of prior aortic surgery (HR 2.44, 95% CI 1.04-5.74) and history of COPD (HR 2.69, 95% CI 1.17-6.21). RIFS was improved by the use of a tube graft during the index operation (HR 0.71, 95% CI 0.53, 0.96).
CONCLUSIONS: Open aortic operations are durable with few long-term complications. When complications occur, the majority are identified by physical exam and clinical presentation. Routine surveillance duplex identifies few findings that lead to re-intervention. Patients with COPD, history of prior aortic surgery and a non-tube graft reconstruction are at greater risk for re-intervention and may benefit from surveillance duplex after open aortic operations.

Presentation Number: MP38

Publishing Title: Endovascular Repair of Ruptured Abdominal Aortic Aneurysms with the Endurant Stent-Graft

Author Block: Konstantinos Papazoglou, MD[1], **Alexandros Mallios**[2], Pavlos Antoniadis, MD[3], Christos Karkos, MD[1], Dimitris Staramos, MD[3], Konstantinos Dervisis, MD[3], John Blebea, MD, MBA[2]
[1]Hippokratio University Hospital, Thessaloniki, Greece, [2]University of Oklahoma, Tulsa, OK, [3]Agia Olga Hospital, Athens, Greece.

Abstract Body:
OBJECTIVES: Endovascular repair of ruptured abdominal aortic aneurysms has previously been reported to reduce mortality rates. Newer stent grafts may provide even better results with applicability in a larger number of patients. We present our outcomes with the Endurant endograft during a three-year period.
METHODS: Consecutive cases of ruptured abdominal aortic aneurysms were retrospectively analysed. Twenty patients (19 male; mean age 75 ± 9 years) were treated with the Medtronic Endurant abdominal stent graft between the years 2010 and 2013.
RESULTS: The technical success rate was 100% with no intra-operative endoleaks. Thirty-day mortality was 15% (3/20 patients). Two patients required prolonged hospitalization and mechanical ventilation. For the remaining 15 patients the average hospitalization length was 6 days. Two major risk factors were found to be associated with increased mortality. These included a low systolic blood pressure on arrival at the hospital (63 ± 6 vs 96 ± 20 mmHg; p=0.01) and the post-operative development of an abdominal compartment syndrome (OR= 58, 95% CI: 2-1863; p=0.02). Other important clinical variables which did not significantly affect mortality included age (83 ± 9 vs 73 ± 9, of those who died and survived, respectively; p=0.10), type of graft (bifurcated vs aorto-uni-iliac; OR=2.3, 95% CI: 0.2-35; p=0.50), aneurysm diameter (10.5 ± 3.5 vs 9.4 ± 1.9 cm; p=0.41), and proximal neck angulation (68 ± 14o vs 65 ± 20o; p=0.78). Even exceeding 75o of proximal neck angulation was not associated with a higher mortality rate (OR=1.2, 95% CI: 0.08-16.4; p=0.8)
CONCLUSIONS: Endograft repair of ruptured abdominal aortic aneurysms resulted in high technical success and low mortality rates in this series of patients treated with the Endurant stent graft. Hypotension on arrival to the hospital and development of an abdominal compartment syndrome were predictive of increased risk of death. Patient age, aneurysm diameter, and graft configuration did not negatively affect survival. Success in patients with severe aortic neck angulation, exceeding manufacturer's instruction for use, suggest that supra-renal fixation and newer stent design of the Endurant graft may provide better results in this challenging group of patients.