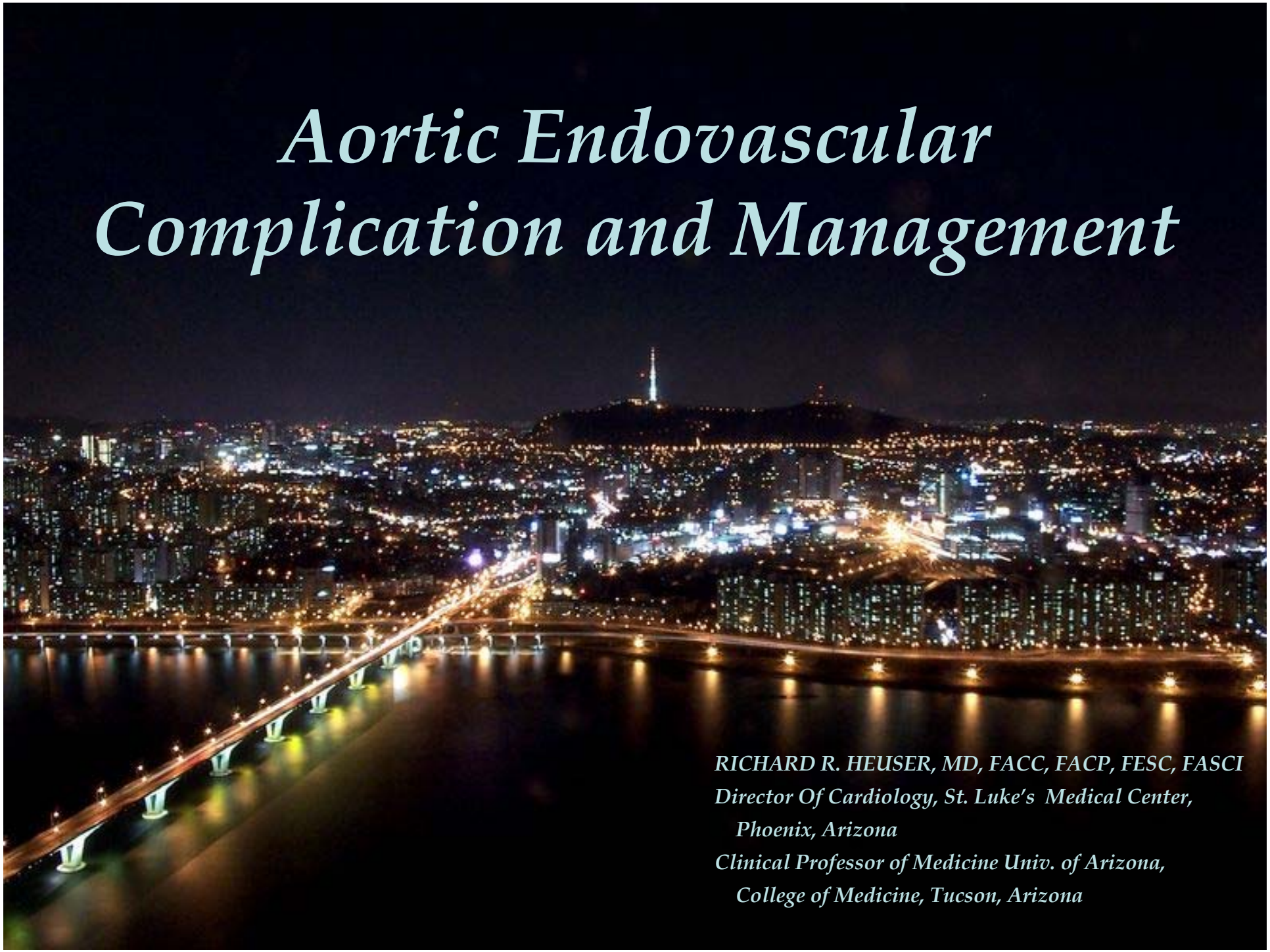
Aortic Endovascular Complication and Management



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Director Of Cardiology, St. Luke's Medical Center, Phoenix, Arizona
Clinical Professor of Medicine Univ. of Arizona, College of Medicine, Tucson, Arizona

Presenter Disclosure Information

Name: ***RICHARD R. HEUSER M.D.***

Within the past 12 months, the presenter or their spouse/partner have had a financial interest/arrangement or affiliation with the organization listed below.

Company Name	***Relationship***
QuantumCor	*Major Stock Holder/Medical Director*
Kensey Nash	*Honorarium*
CSI	*Stockholder*

Patents *-- RF, Snares, Wires, Balloon Catheters, Covered Stents, Devices for Arterial Venous Connection, Devices for LV and RV Closure*

Aneurysms History

- *A description of traumatic aneurysms of the peripheral arteries in the Ebers Papyrus (2000 B.C.)*
- *Antyllus in 2nd century AD recommended ligating the artery above and below and evacuating the contents*
- *Brachial artery false aneurysms common complication of blood letting*

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Aneurysm Famous People

- *Albert Einstein*
- *Kit Carson*
- *George C. Scott*
- *Archie Bunker*
- *Lucille Ball*
- *John Ritter*

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Aortic Aneurysms

- *13th leading cause of death in the United States*
- *15,000 deaths from rupture per year*

Aortic Aneurysms

- *Incidence has increased fourfold 9/1000 to 37/1000 over the past 2 decades*
- *Same time period deaths from stroke and MI decreased 30-40%*

Aneurysms

- *1st successful [illegible] aneurysm repair was in 19[illegible] by Norman Freeman using an autogenous iliac vein graft*
- *Charles Dubost used an aortic homograft to replace the aneurysm*
- *1st Complete Repair Occurred September 2, 1954 – Michel DeBakey*

THESE THERAPIES HAVE NEVER BEEN SUBJECTED TO LEVEL 1 EVIDENCE

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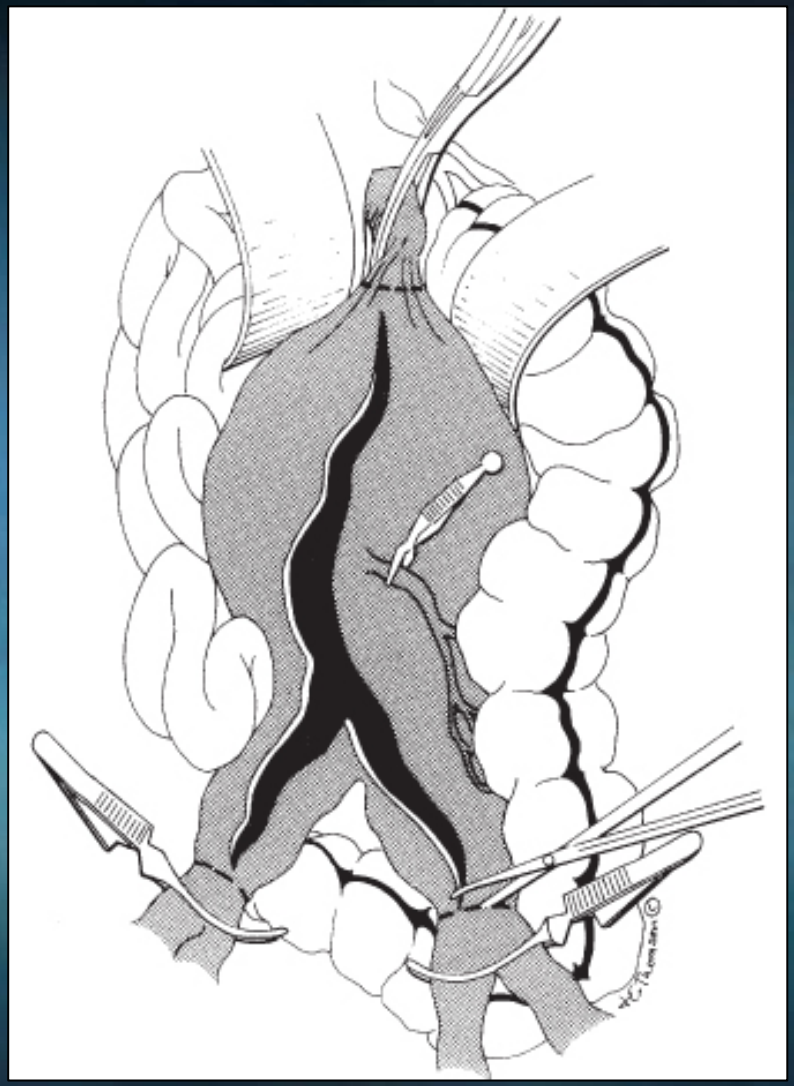

Transabdominal aortic aneurysm exposure, vascular clamps in place, incising the aneurysm.

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Table 100-3 Independent Risk Factors for Operative Mortality After Elective Abdominal Aortic Aneurysm Repair

RISK FACTOR	ODDS RATIO*	95% CI
Creatinine >1.8 mg/dL	3.3	1.5-7.5
Congestive heart failure	2.3	1.1-5.2
ECG ischemia	2.2	1-5.1
Pulmonary dysfunction	1.9	1-3.8
Older age (per decade)	1.5	1.2-1.8
Female gender	1.5	0.7-3

*Odds ratio indicates relative risk compared with patients without that risk factor.
CI, confidence interval.

From Steyerberg EW, Kievit J, Alexander de Mol Van Otterloo JC, et al: Perioperative mortality of elective abdominal aortic aneurysm surgery: A clinical prediction rule based on literature and individual patient data. Arch Intern Med 155:1998, 1995.

Aneurysms

Minimally [illegible] Approaches

EINSTEIN HAD THIS DONE IN 1949

FOR A SYMPTOMATIC ABDOMINAL

AORTIC ANEURYSM

- *[illegible]mbose with electric current between needles stuck into [illegible] 1832-1930's*
- *1864 [illegible] into the aneury[illegible] to 26 yards)*
- *Wrap in cellophane*

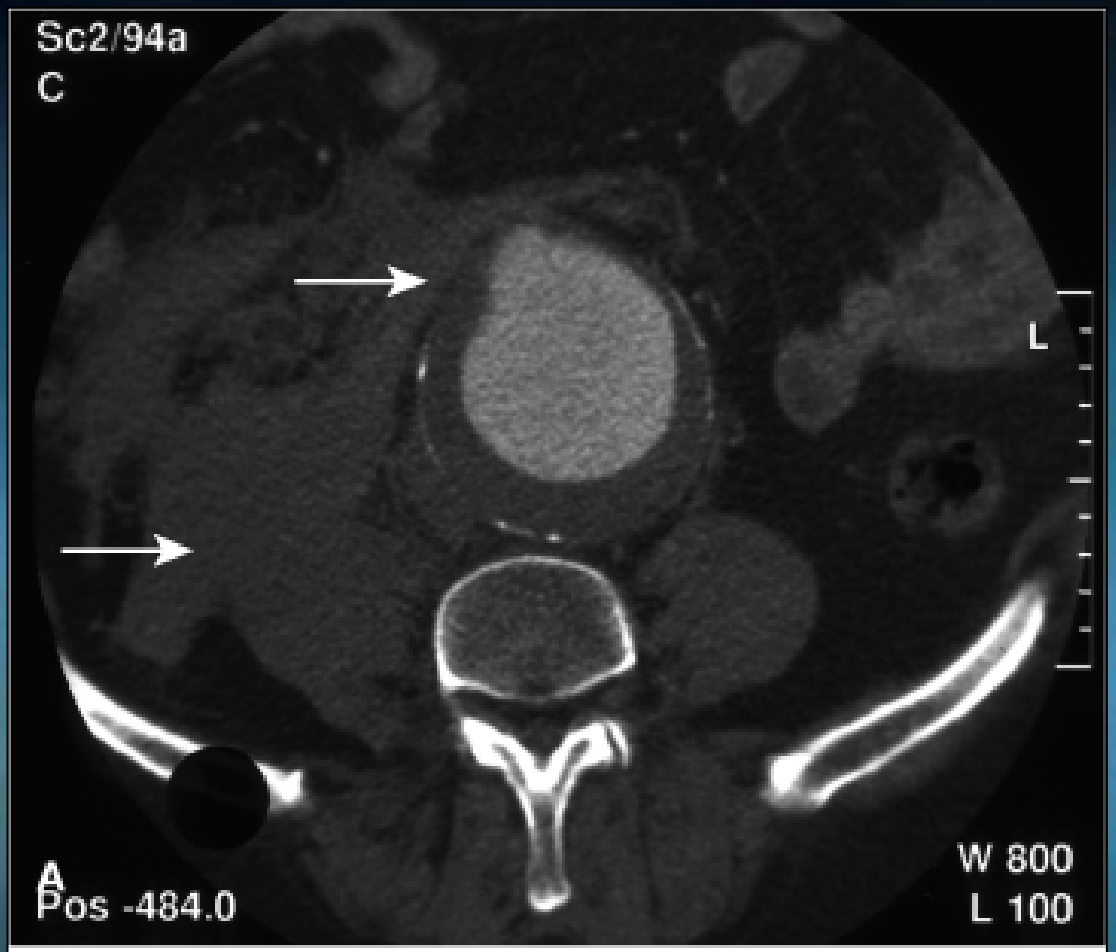

Figure 101-10 A, CT of ruptured AAA subsequently treated with endovascular aneurysm repair. Small arrow indicates site of rupture, and bold arrow indicates retroperitoneal hematoma. B, Postoperative angiogram after aorto-uni-iliac endografting and femorofemoral bypass.

Aortic Aneurysm Rupture

- *50% will die prior to getting medical help*
- *Contained rupture patients easiest to treat*
- *Mortality for repair of ruptured aortic aneurysms 50-90%*

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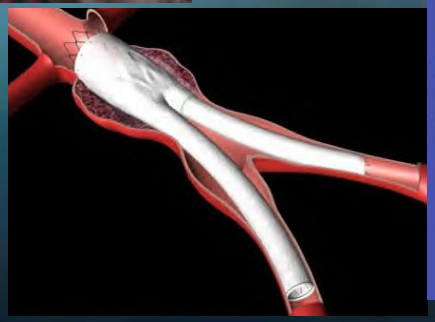
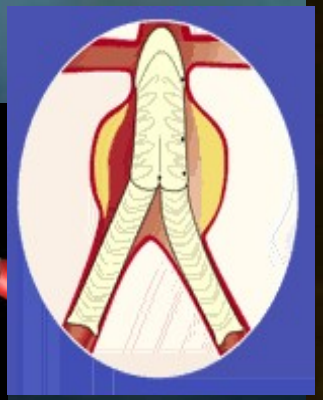
AAA Stent Grafts

* Exciting alternative to open surgery
* Continued interest despite product setbacks
* Industry responding with design changes
* Various design approaches





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Endoluminal Stent-Graft Demonstrated Advantages

- *Minimally invasive surgery*
- *Reduced morbidity and mortality*
- *Less blood loss/need for transfusion*
- *Shorter hospital stay*
- *Quicker recuperative time*

PATIENT PREFERRED TREATMENT

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Potential Endoluminal Graft Complications

- *Dissection/Perforation*
- *Device malfunction/failure*
- *Thromboembolic Event*
- *Prosthetic Occlusion*
- *Prosthetic Migration*
- *Prosthetic Leak*
- *Limb Ischemia*
- *Ischemic Bowel*
- *Renal Failure*
- *Wound Infection*
- *Coagulopathy*
- *MI*
- *Arrythmias*

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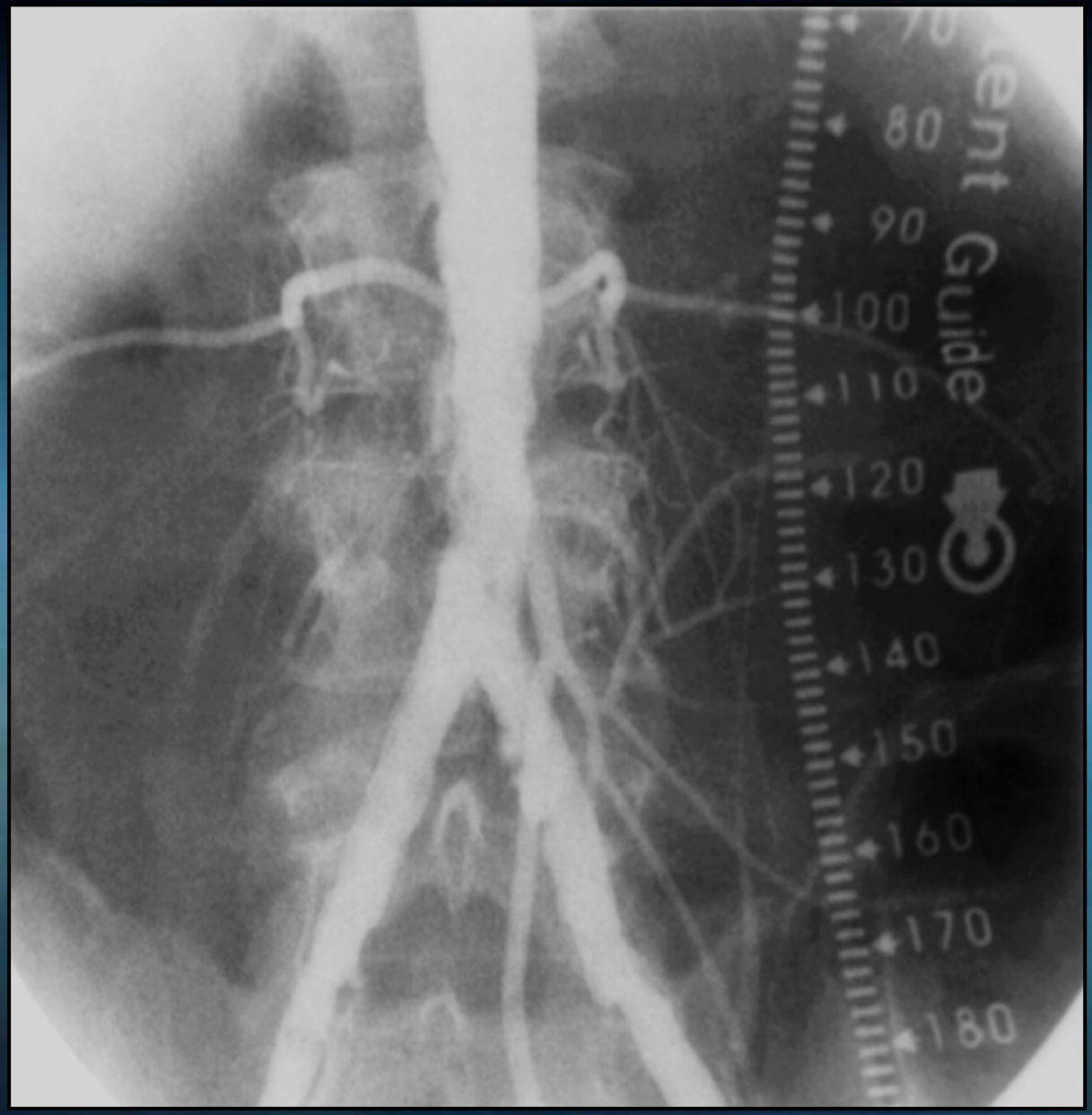
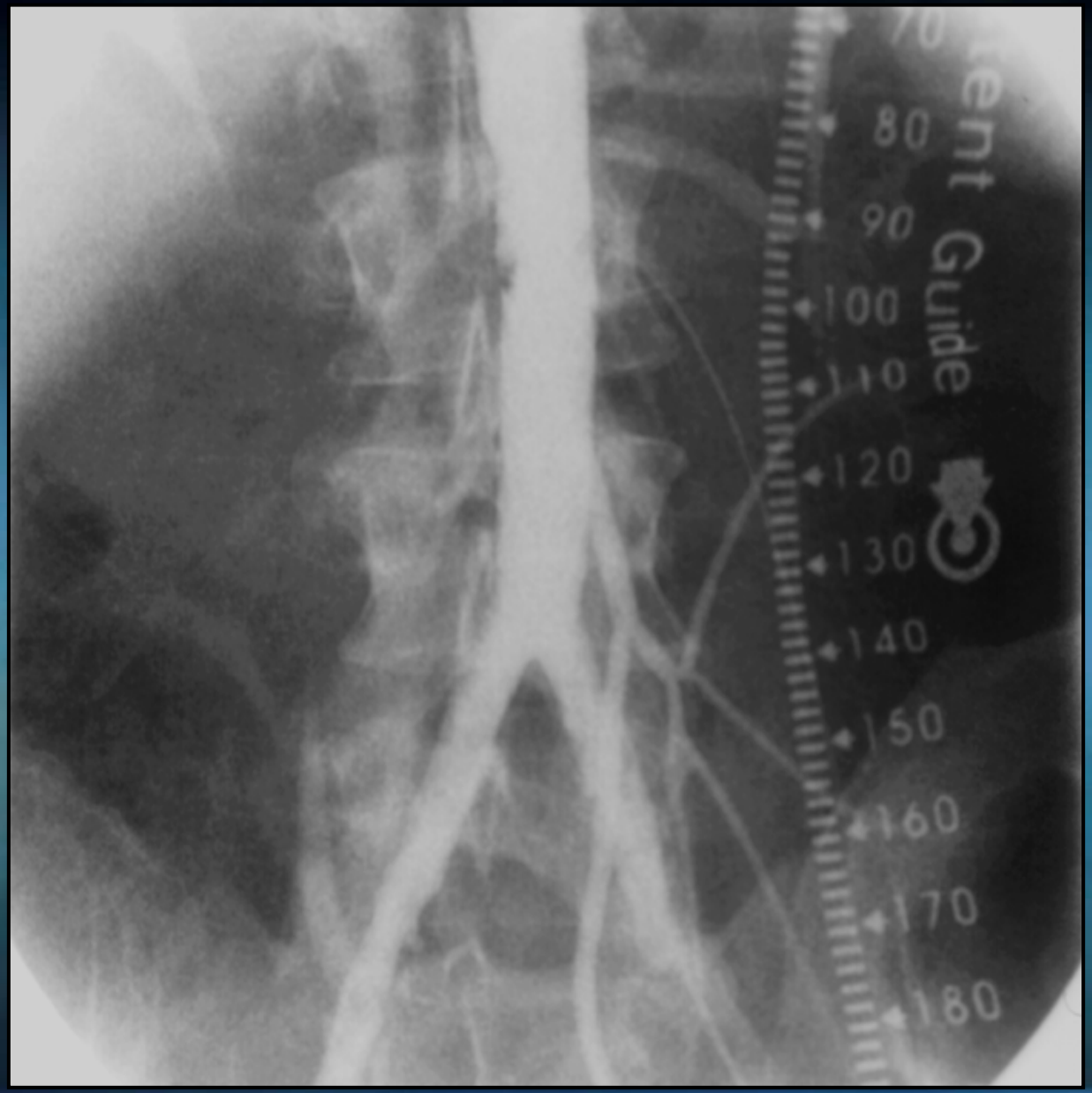


R. Heuser D.A.



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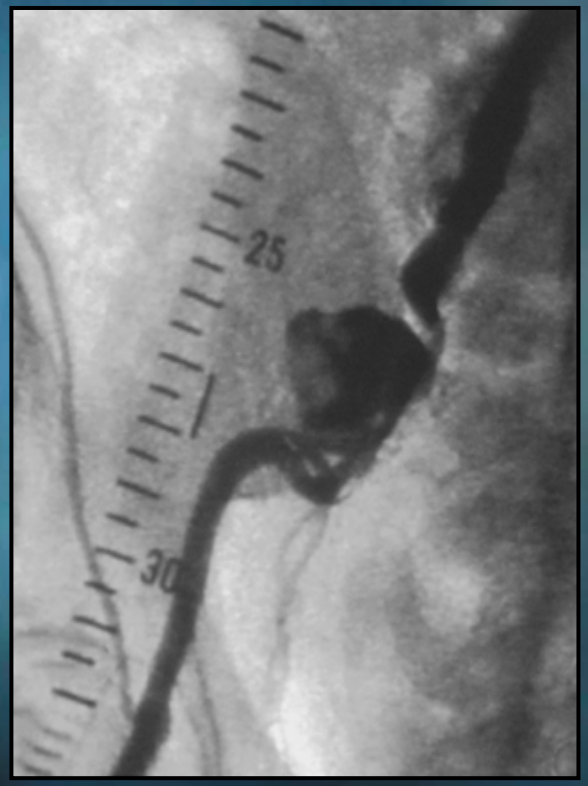
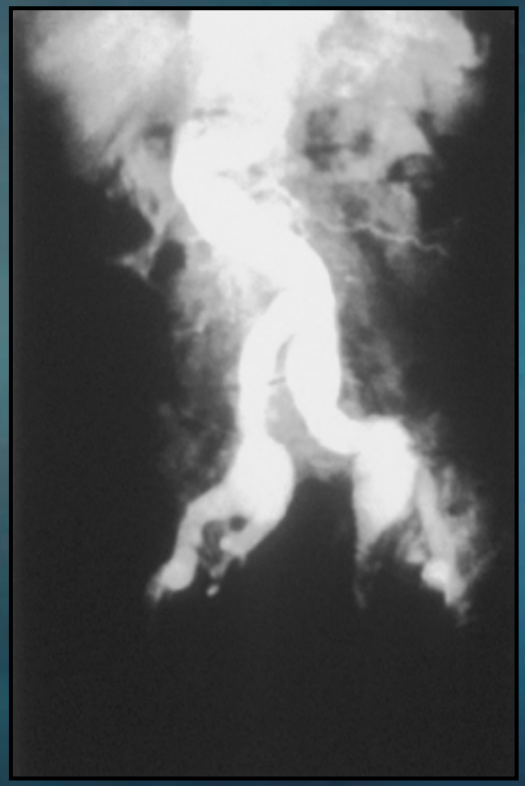
Iliac Aneurysms





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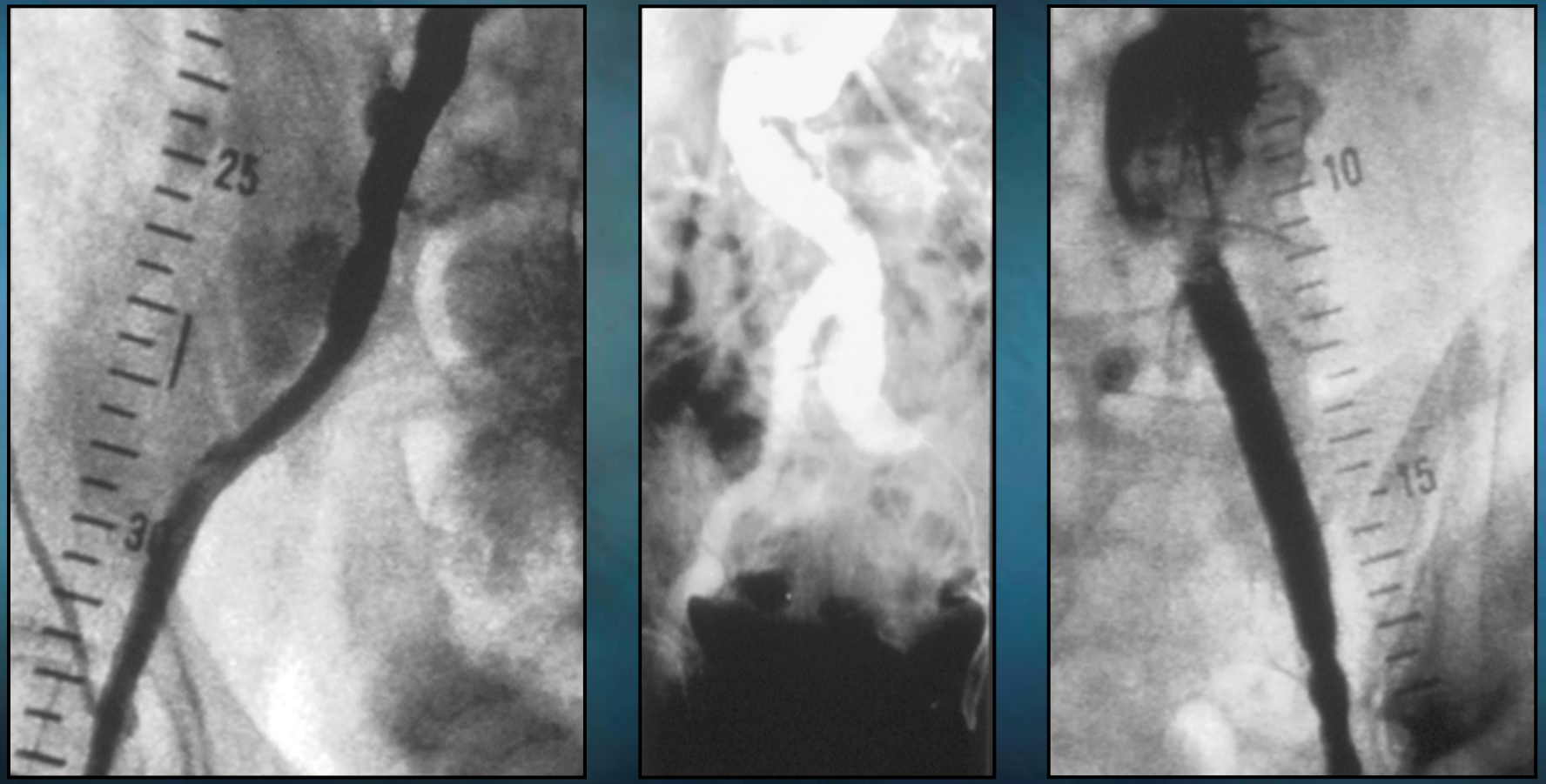
Iliac Aneurysm Corrections With ELG



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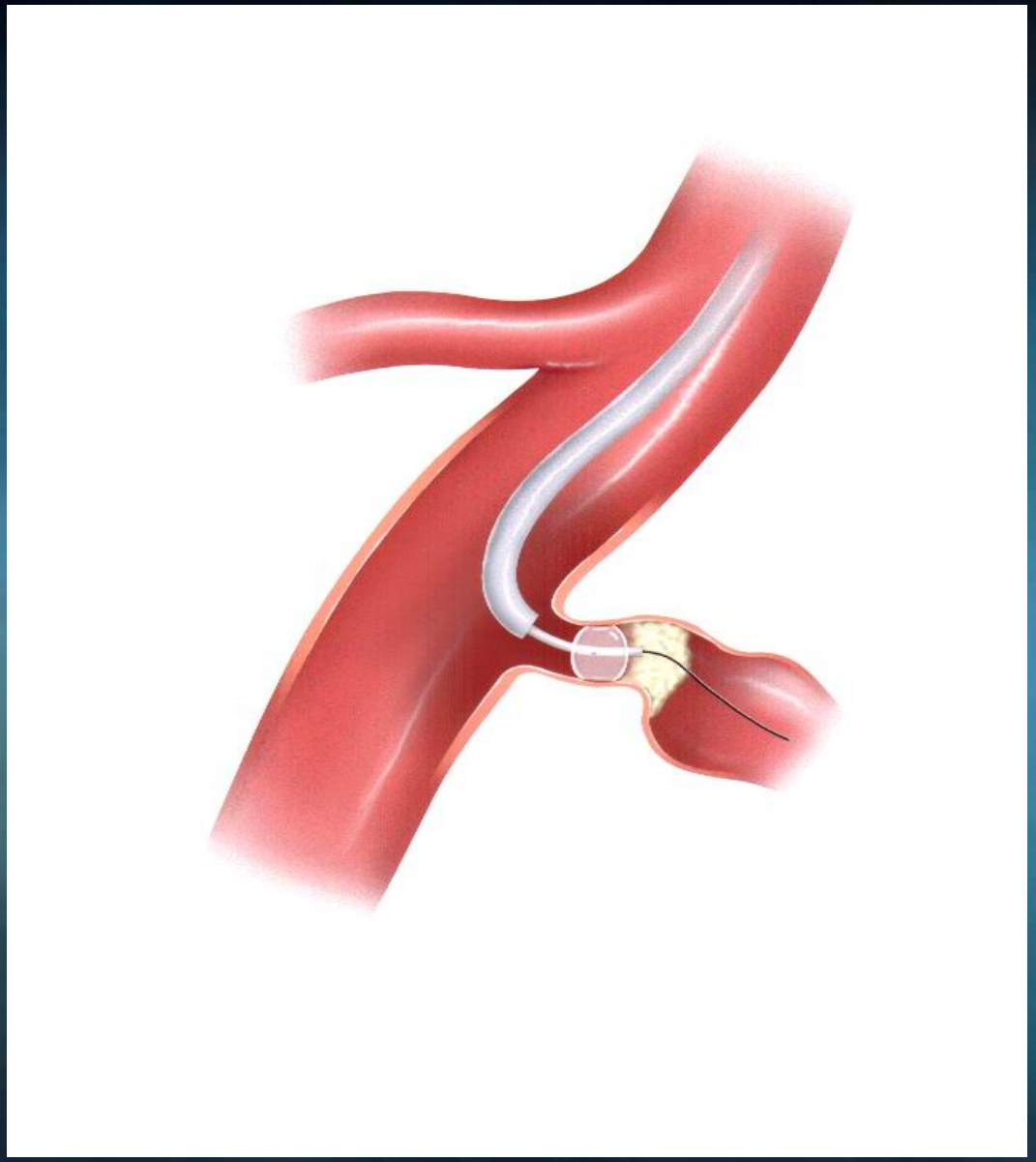

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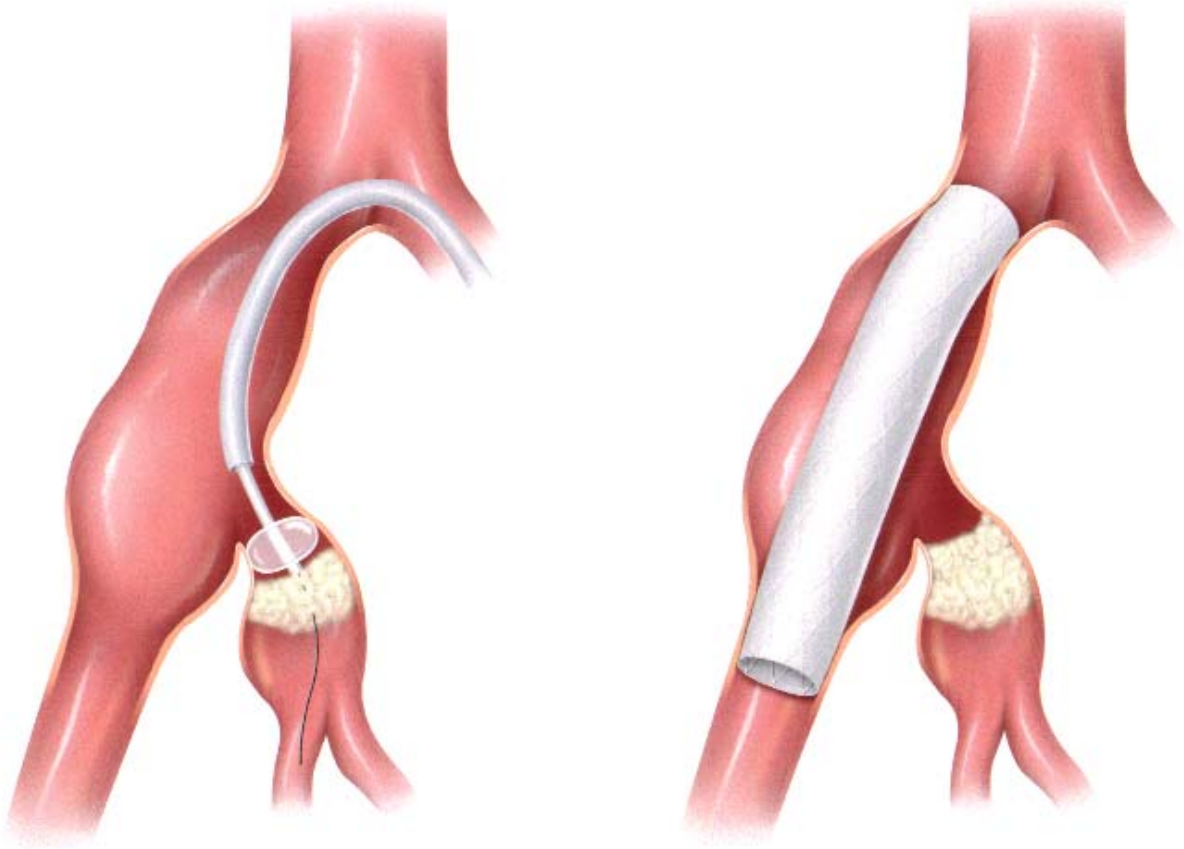

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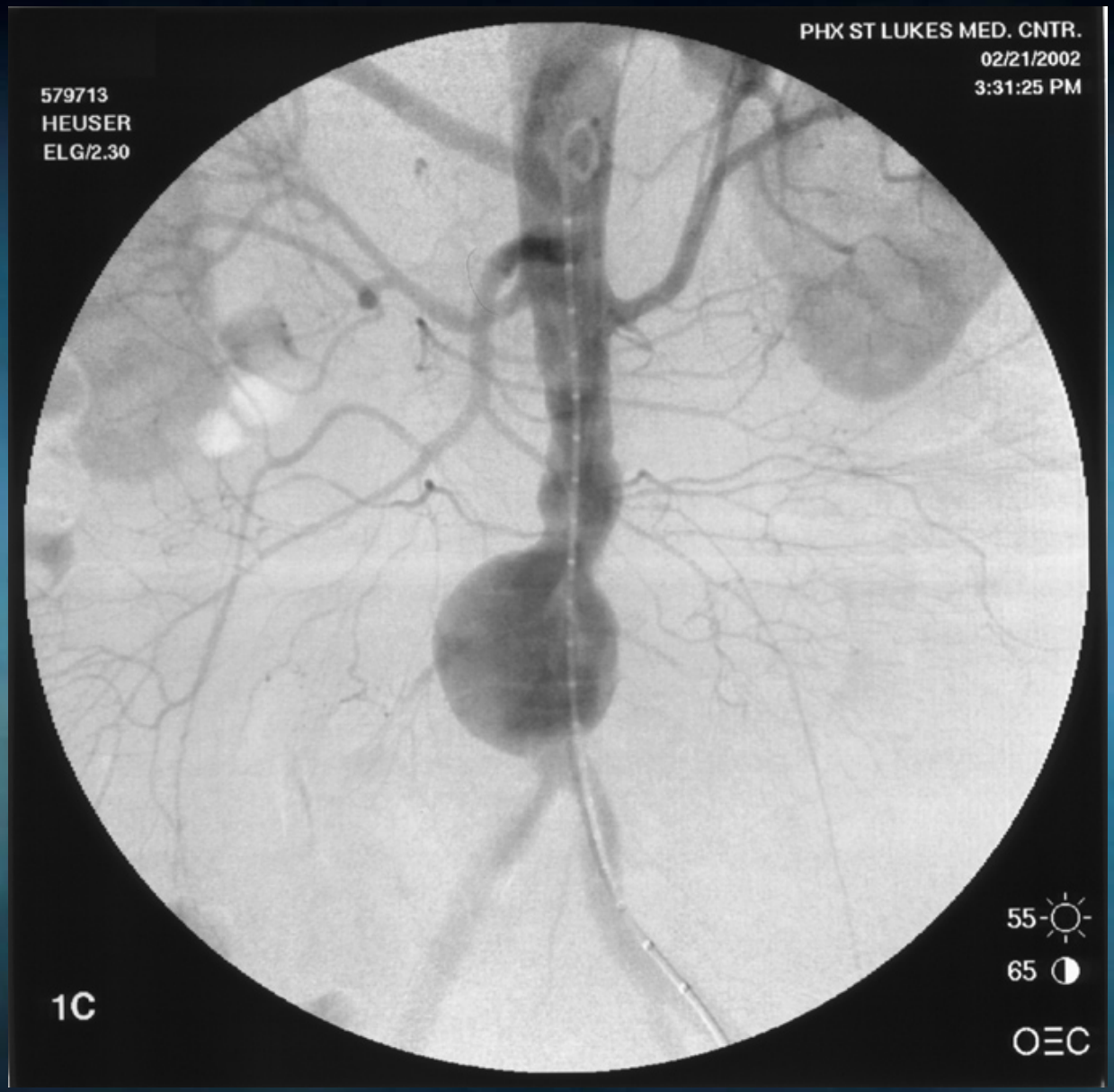
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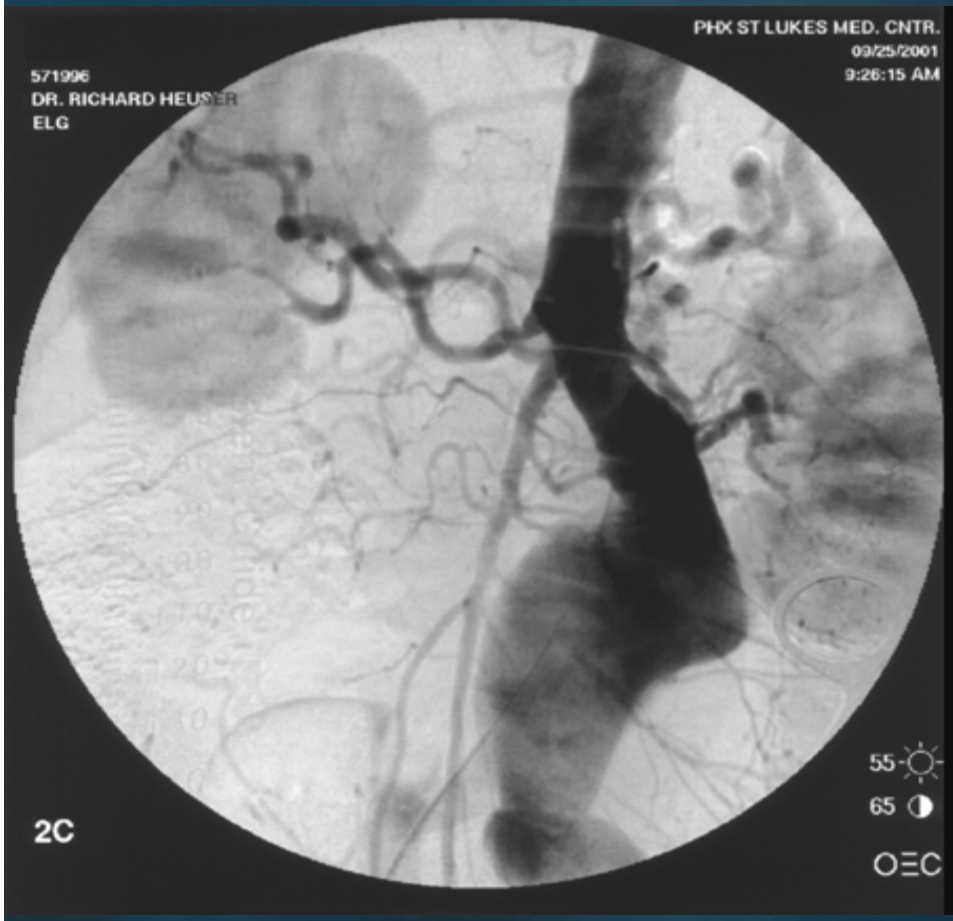
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BUSINESS/FINANCIAL DESK | June 17, 2003, Tuesday

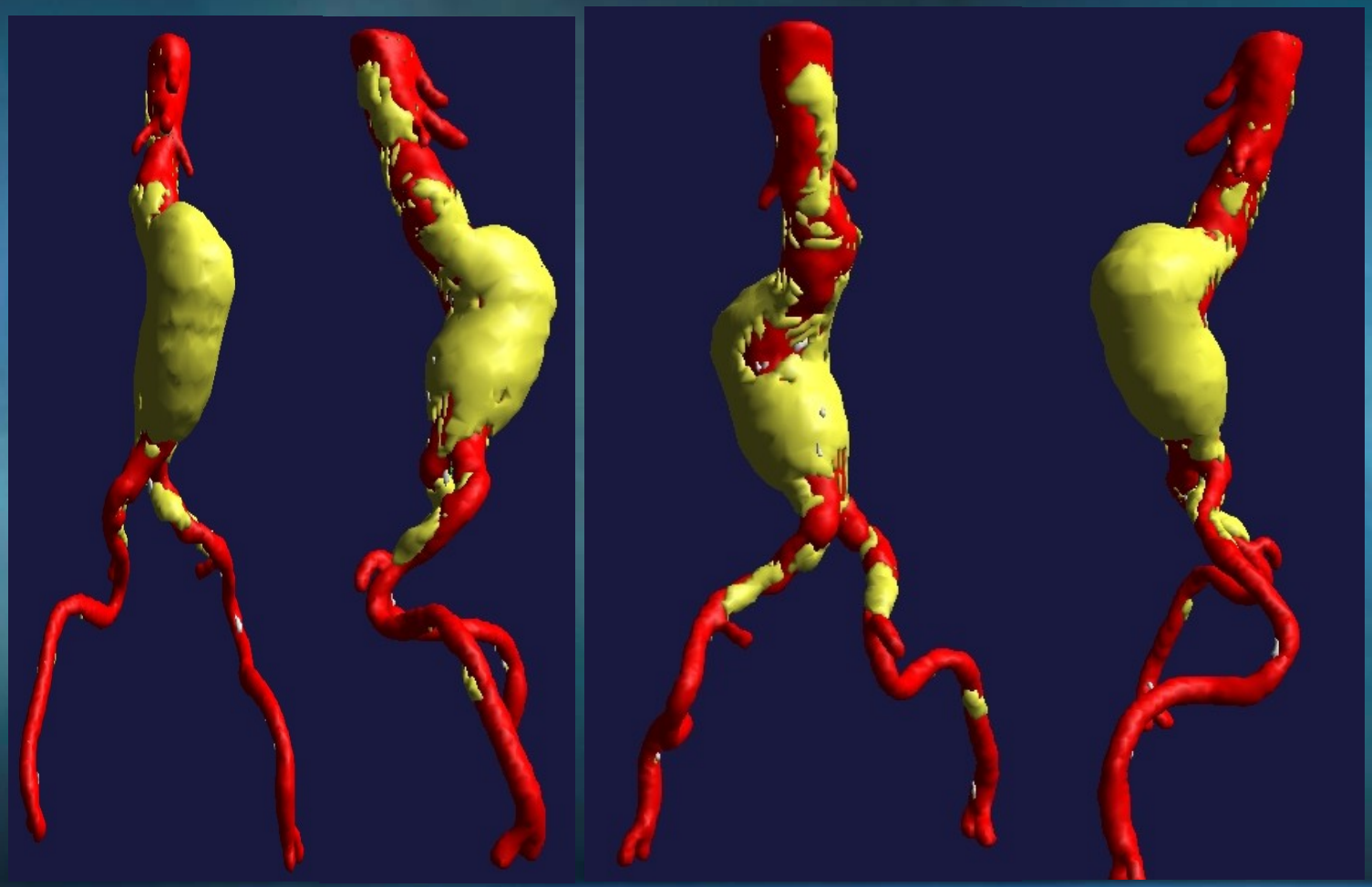
Medical Concern Will Halt Sales Of Artery Device Linked to Deaths

By MELODY PETERSEN (NYT) 746 words

Late Edition - Final , Section C , Page 1 , Column 5

ABSTRACT - Guidant Corp to stop selling device that helps treat weakened abdominal aorta after admitting it concealed thousands of problems linked to product; says 18,000 patients who already have device are safe because problems center on system used to insert it, not device itself; says it will continue to support those patients over years; group chairman Jay Graf says potential liability from dozen suits filed on behalf of patients who died or were injured by device is 'manageable' because product liability insurance will help pay costs (M)

Early Clinical Evaluation



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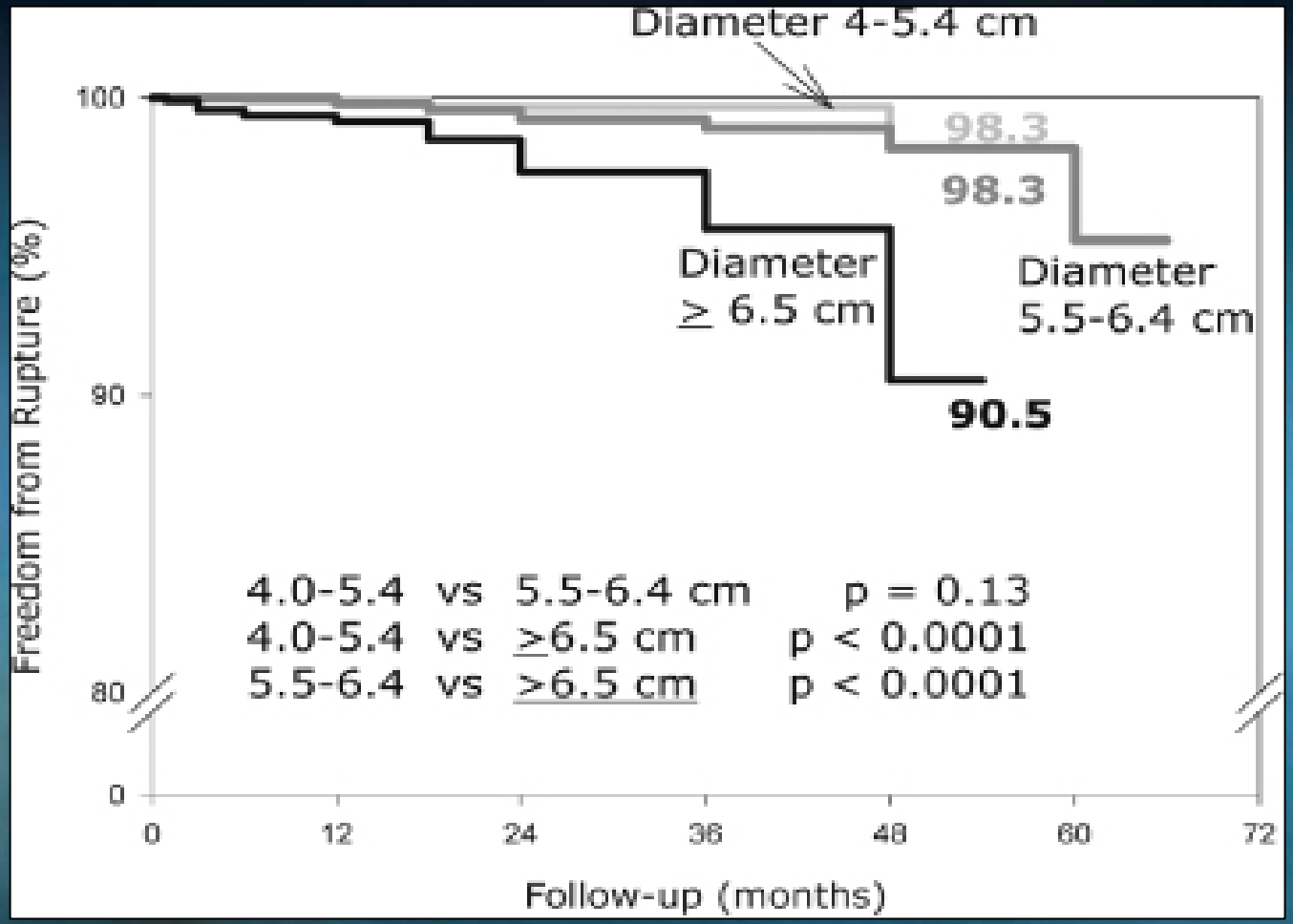

Cumulative freedom from rupture after endovascular aneurysm repair in patients with aneurysms measuring 4 to 5.4 cm, 5.5 to 6.4 cm, and more than 6.5 cm. (From Ouriel K, Clair DG, Greenberg RK, et al: Endovascular repair of abdominal aortic aneurysms: Device-specific outcome. J Vasc Surg 37:991-998, 2003.)

SINCE THE FIRST REPORT OF ENDOVASCULAR repair of abdominal aortic aneurysm in 1991, the technique has become a mainstay in the repair of abdominal aortic aneurysm, accounting for over 40% of elective repairs of abdominal aortic aneurysm in 2003 (Fig. 1).[1-3] Randomized trials have shown a perioperative survival benefit of endovascular repair over open repair, with fewer complications and a shorter recovery.[4,5]

There are concerns, however, that longer-term outcomes of endovascular repair may not be as durable as those of open repair, with endovascular repair increasing the risk of late rupture of the abdominal aortic aneurysm and necessitating more frequent reinterventions — including conversion to open repair — to preserve the integrity of the aneurysm repair.[6] The risks of complications and death, as well as the expense, associated with these additional procedures may offset the initial survival benefit observed with endovascular repair.[7-9] In addition, patients enrolled in the clinical trials were highly selected and were generally treated at high-volume referral institutions. Therefore, the experience in those trials may not reflect that in actual practice.

Currently, there are limited data regarding long-term reintervention and rupture after open repair[10,11] or endovascular repair.[6,7,12,13] In addition, there are few data on laparotomy-related reinterventions for problems such as bowel obstruction and abdominal-wall hernia that arise as late complications of open repair. In this study, we used data from the Medicare program to compare short-term and long-term outcomes among matched cohorts of patients with abdominal aortic ancurysm who underwent open or endovascular repair during the 2001–2004 period.

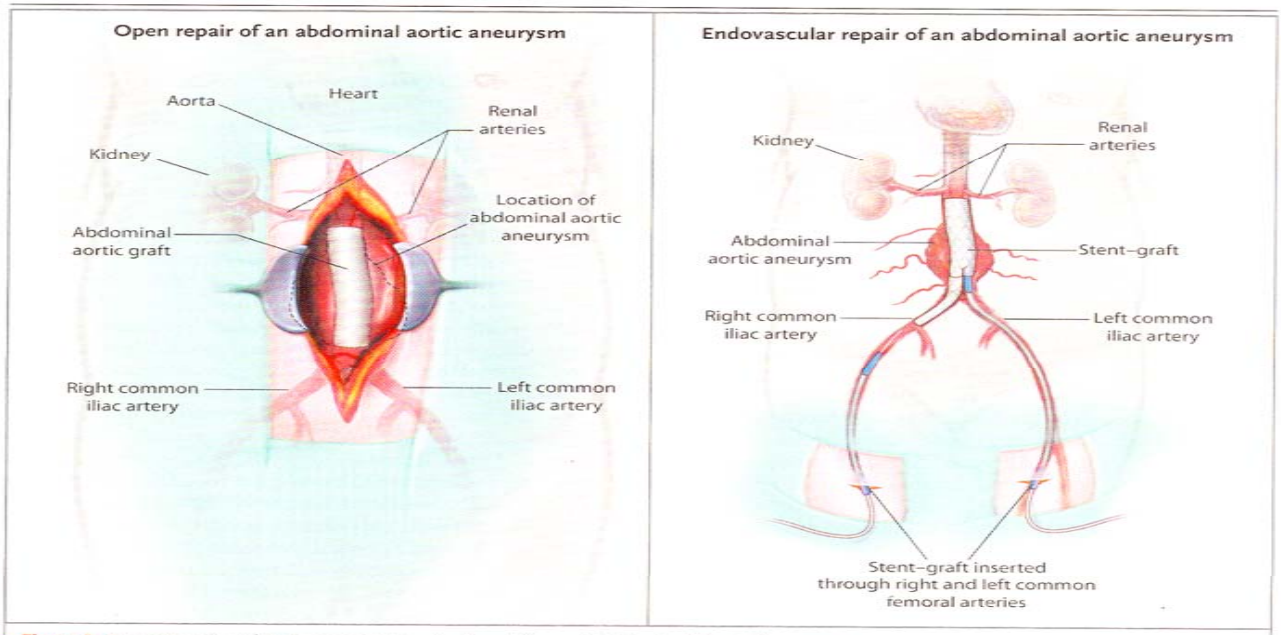

Figure 1. Open Repair and Endovascular Repair of an Infrarenal Abdominal Aortic Aneurysm.
In endovascular repair, a stent–graft inserted through the right groin is placed just below the renal arteries, and the left limb of the bifurcated device is inserted through the left groin to overlap with the main body of the stent–graft.

OPEN REPAIR

- *Does Require Lifelong Follow Up and Surveillance*
- *5% Have Endoleaks or Pseudoaneurysms*
- *Only 64% Fully Ambulatory Post Open Repair*

18% WHO HAD OPEN REPAIR

WOULD NOT HAVE IT AGAIN

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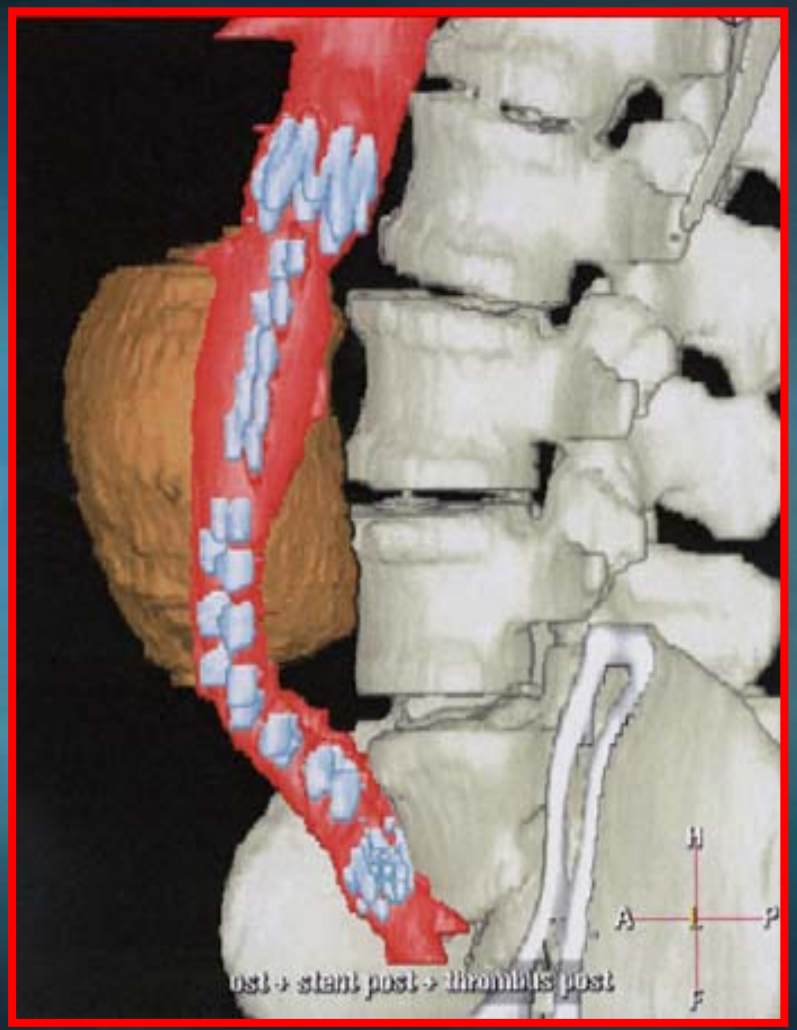

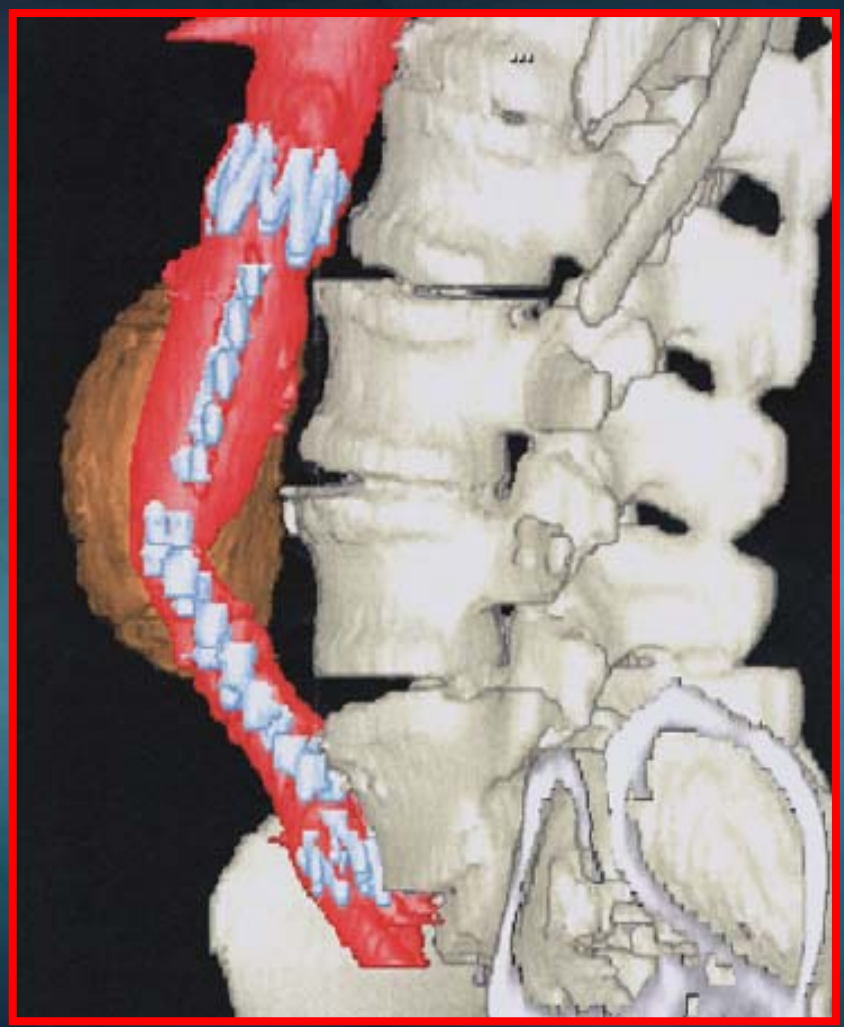

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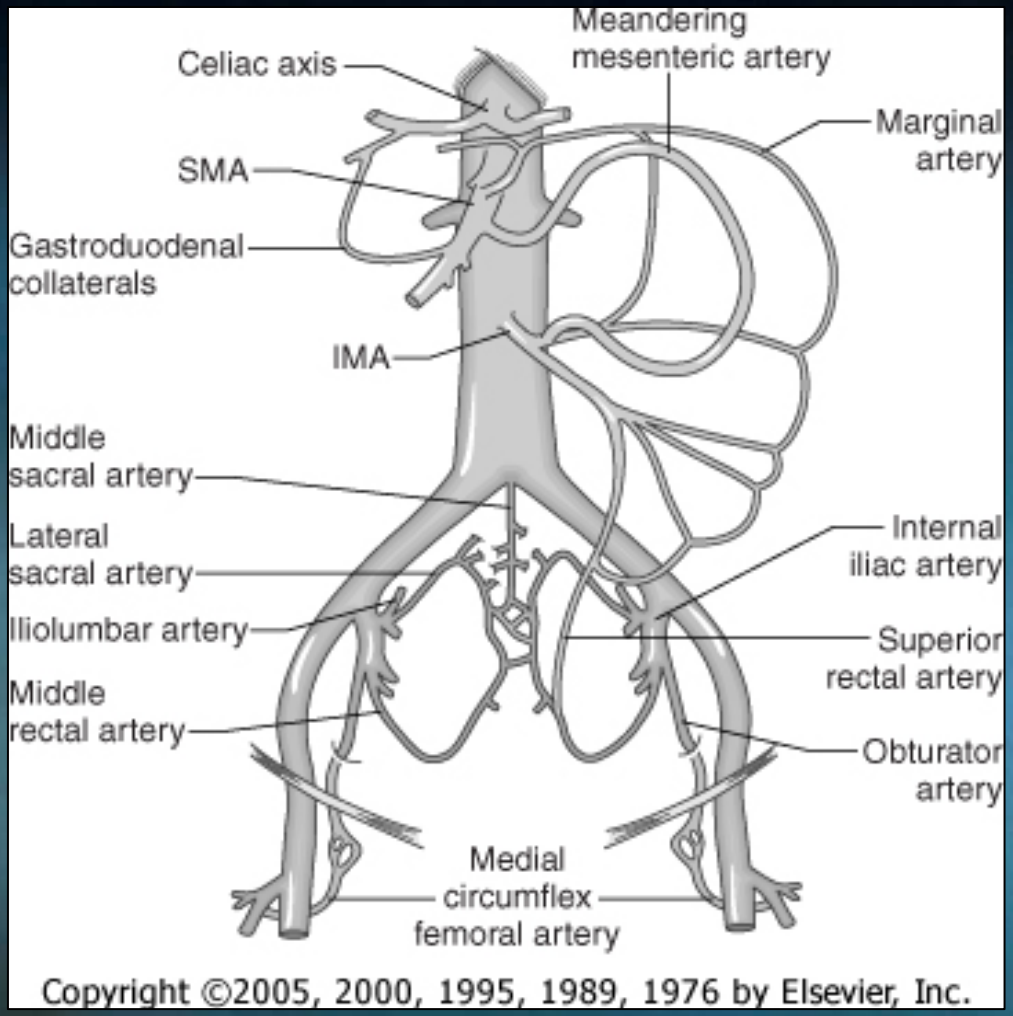
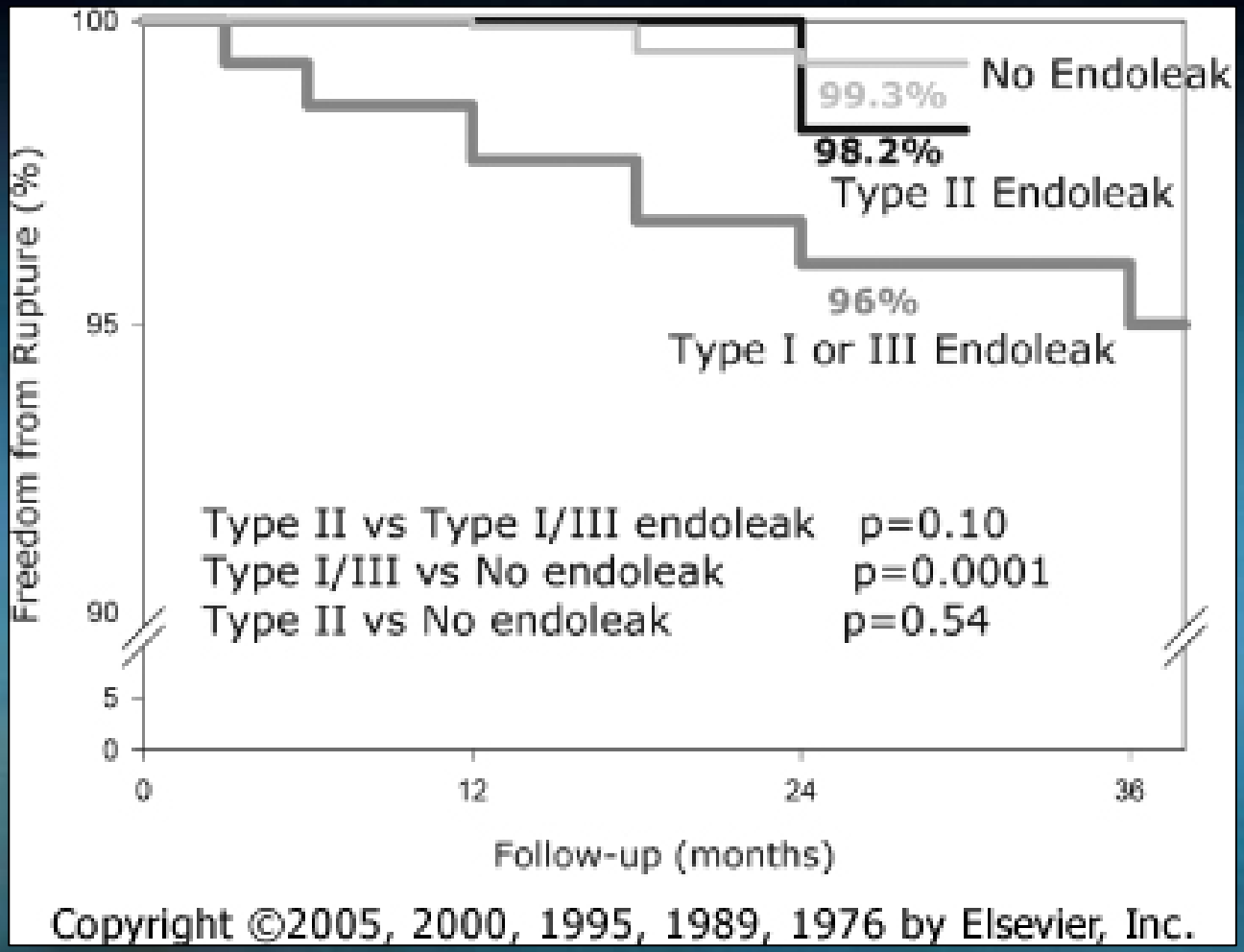


Figure 100-13 Important collateral pathways for the sigmoid colon and pelvis. IMA, inferior mesenteric artery; SMA, superior mesenteric artery. (From Bergman RT, Gloviczki P, Welch TJ, et al: The role of intravenous fluorescein in the detection of colon ischemia during aortic reconstruction. Ann Vasc Surg 6:74, 1992.)



Freedom from aneurysm rupture after endovascular aneurysm repair in patients categorized according to endoleak: with isolated type II endoleak, with type I or type III endoleak, and without endoleak.
(From Van Marrewijk C, Buth J, Harris PL, et al: Significance of endoleaks after endovascular repair of abdominal aortic aneurysms: The EUROSTAR experience. J Vasc Surg 35:461-473, 2002.)

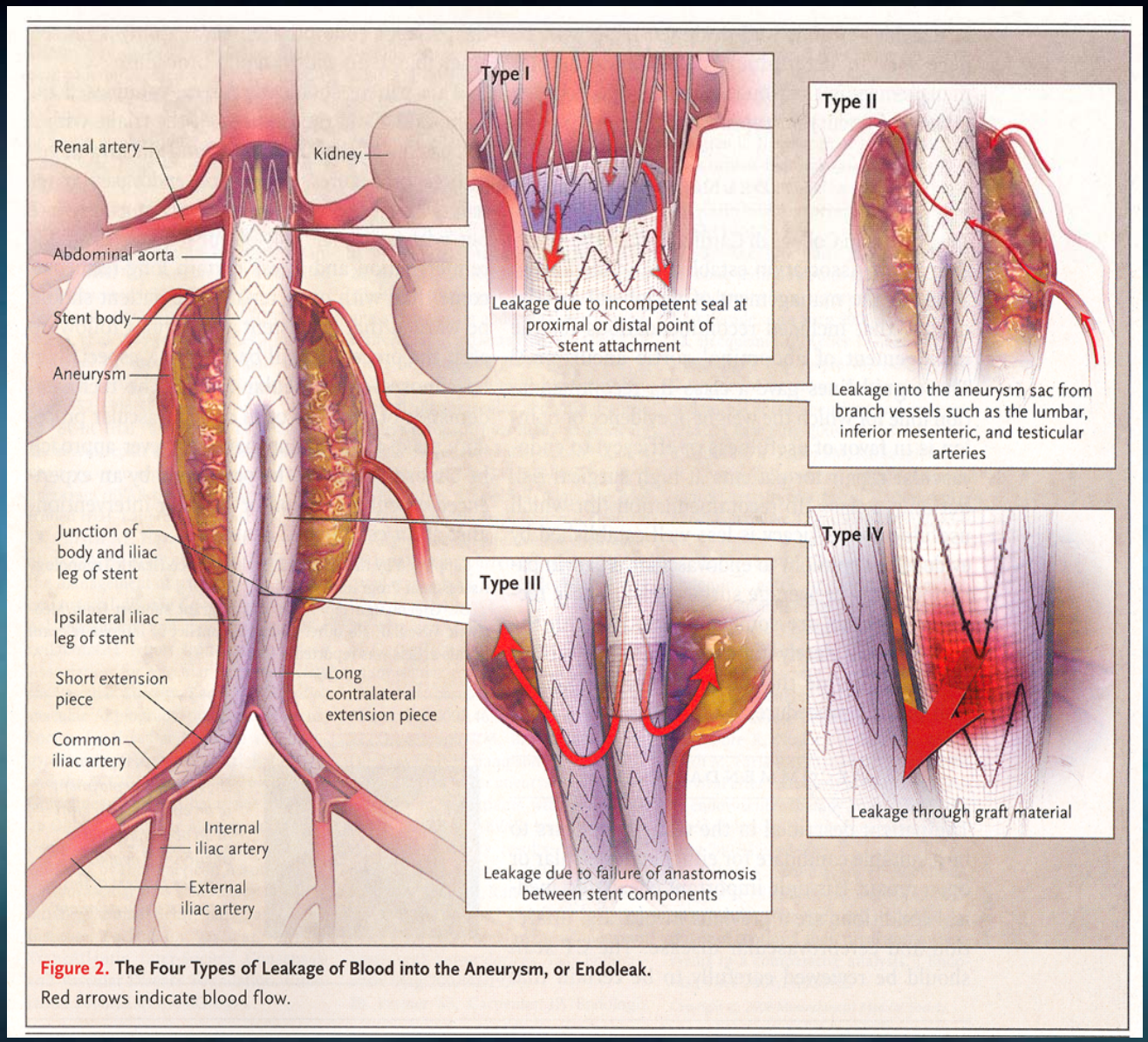


Figure 2. The Four Types of Leakage of Blood into the Aneurysm, or Endoleak.
Red arrows indicate blood flow.

N Eng J Med 338;5, January 31, 2008, p. 499

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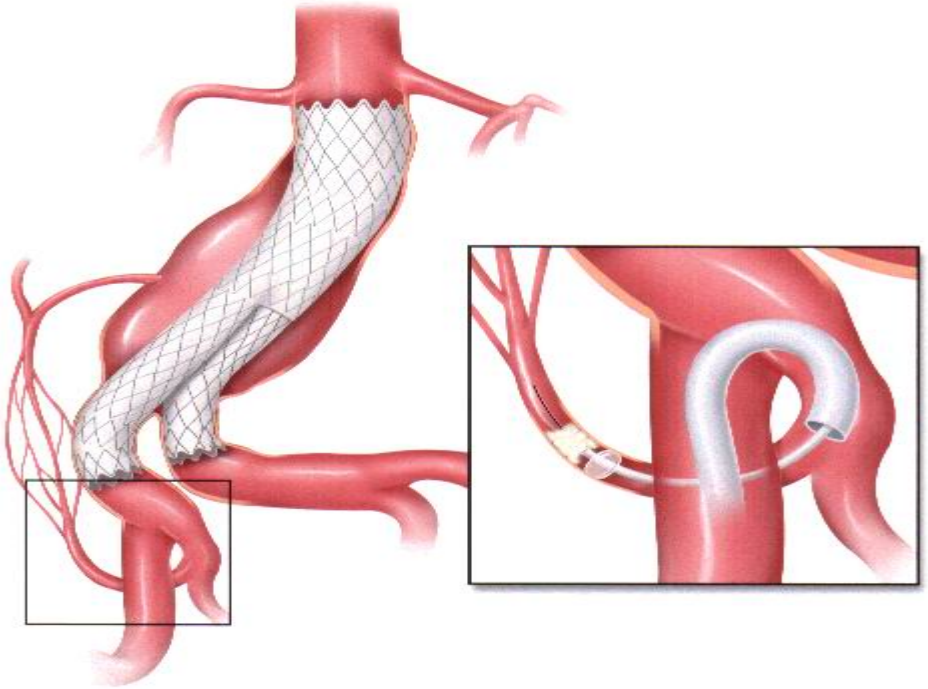
TYPES, ETIOLOGY, AND TREATMENT OF ENDOLEAKS

Type	Etiology	Treatment
1	Attachment Site	PTA, Balloons, Stents
2	Collaterals	Embolization
3	Graft Failure	Graft Repair
4	Pourosity	No Treatment Needed



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The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Endovascular vs. Open Repair of Abdominal Aortic Aneurysms in the Medicare Population

Marc L. Schermerhorn, M.D., A. James O'Malley, Ph.D., Ami Jhaveri, M.D., Philip Cotterill, Ph.D., Frank Pomposelli, M.D., and Bruce E. Landon, M.D., M.B.A.

ABSTRACT

BACKGROUND

Randomized trials have shown reductions in perioperative mortality and morbidity with endovascular repair of abdominal aortic aneurysm, as compared with open surgical repair. Longer-term survival rates, however, were similar for the two procedures. There are currently no long-term, population-based data from the comparison of these strategies.

METHODS

We studied perioperative rates of death and complications, long-term survival, rupture, and reinterventions after open as compared with endovascular repair of abdominal aortic aneurysm in propensity-score–matched cohorts of Medicare beneficiaries undergoing repair during the 2001–2004 period, with follow-up until 2005.

RESULTS

There were 22,830 matched patients undergoing open repair of abdominal aortic aneurysm in each cohort. The average age of the patients was 76 years, and approximately 20% were women. Perioperative mortality was lower after endovascular repair than after open repair (1.2% vs. 4.8%, P<0.001), and the reduction in mortality increased with age (2.1% difference for those 67 to 69 years old vs. 8.5% for those 85 years or older, P<0.001). Late survival was similar in the two cohorts, although the survival curves did not converge until after 3 years. By 4 years, rupture was more likely in the endovascular-repair cohort than in the open-repair cohort (1.8% vs. 0.5%, P<0.001), as was reintervention related to abdominal aortic aneurysm (9.0% vs. 1.7%, P<0.001), although most reinterventions were minor. In contrast, by 4 years, surgery for laparotomy-related complications was more likely among patients who had undergone open repair (9.7%, vs. 4.1% among those who had undergone endovascular repair; P<0.001), as was hospitalization without surgery for bowel obstruction or abdominal-wall hernia (14.2% vs. 8.1%, P<0.001).

CONCLUSIONS

As compared with open repair, endovascular repair of abdominal aortic aneurysm is associated with lower short-term rates of death and complications. The survival advantage is more durable among older patients. Late reinterventions related to abdominal aortic aneurysm are more common after endovascular repair but are balanced by an increase in laparotomy-related reinterventions and hospitalizations after open surgery.

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SINCE THE FIRST REPORT OF ENDOVASCULAR repair of abdominal aortic aneurysm in 1991, the technique has become a mainstay in the repair of abdominal aortic aneurysm, accounting for over 40% of elective repairs of abdominal aortic aneurysm in 2003 (Fig. 1).[1-3] Randomized trials have shown a perioperative survival benefit of endovascular repair over open repair, with fewer complications and a shorter recovery.[4,5]

There are concerns, however, that longer-term outcomes of endovascular repair may not be as durable as those of open repair, with endovascular repair increasing the risk of late rupture of the abdominal aortic aneurysm and necessitating more frequent reinterventions — including conversion to open repair — to preserve the integrity of the aneurysm repair.[6] The risks of complications and death, as well as the expense, associated with these additional procedures may offset the initial survival benefit observed with endovascular repair.[7-9] In addition, patients enrolled in the clinical trials were highly selected and were generally treated at high-volume referral institutions. Therefore, the experience in those trials may not reflect that in actual practice.

Currently, there are limited data regarding long-term reintervention and rupture after open repair[10,11] or endovascular repair.[6,7,12,13] In addition, there are few data on laparotomy-related reinterventions for problems such as bowel obstruction and abdominal-wall hernia that arise as late complications of open repair. In this study, we used data from the Medicare program to compare short-term and long-term outcomes among matched cohorts of patients with abdominal aortic aneurysm who underwent open or endovascular repair during the 2001–2004 period.

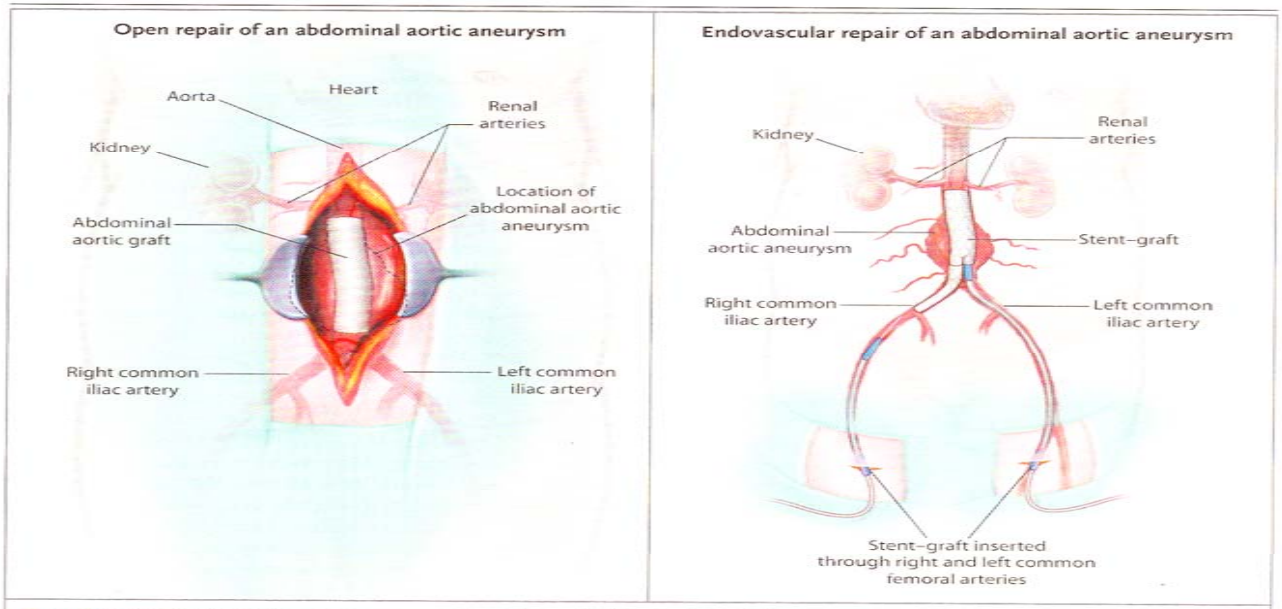

Figure 1. Open Repair and Endovascular Repair of an Infrarenal Abdominal Aortic Aneurysm.
In endovascular repair, a stent–graft inserted through the right groin is placed just below the renal arteries, and the left limb of the bifurcated device is inserted through the left groin to overlap with the main body of the stent–graft.

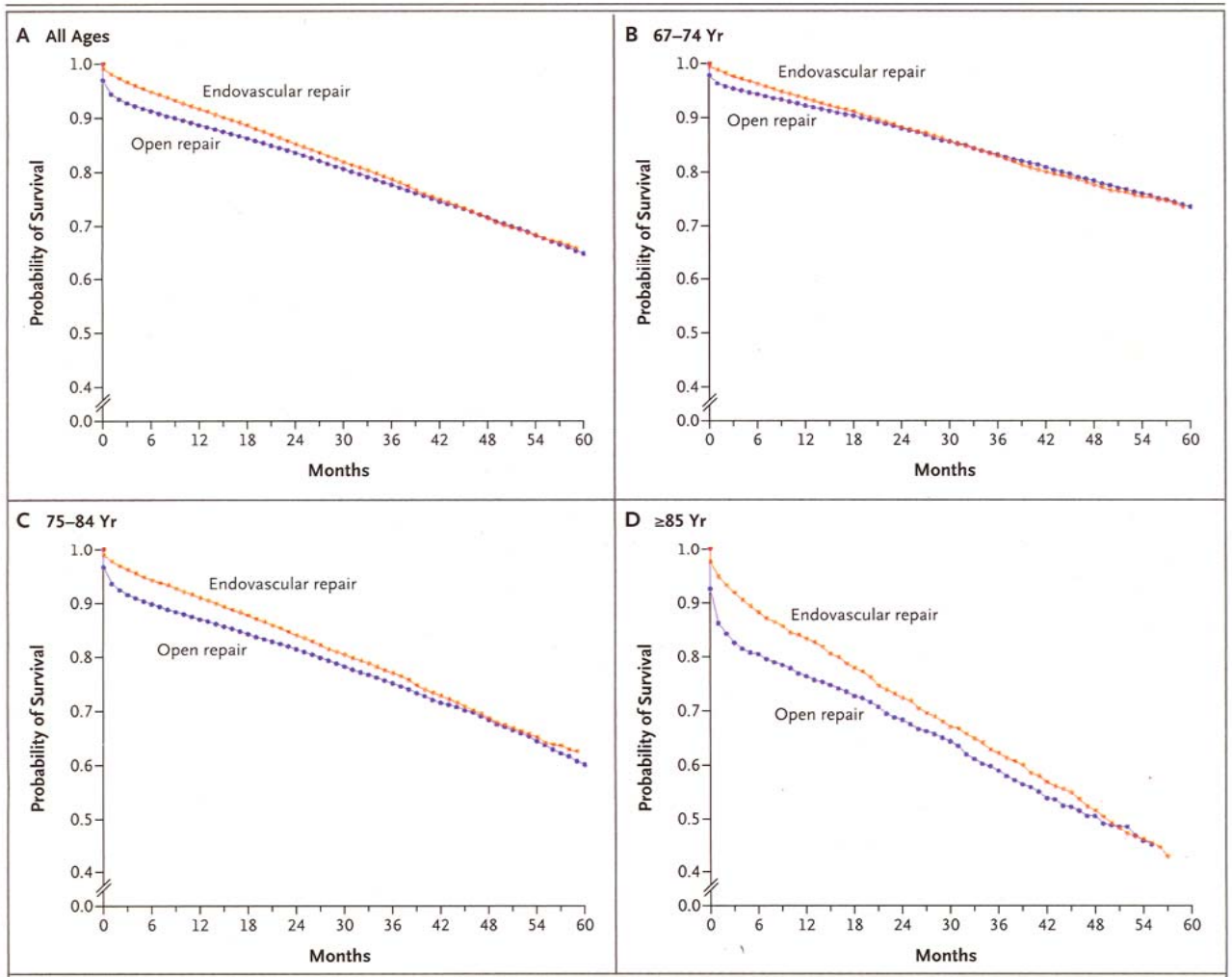

Figure 2. Survival of Patients Undergoing Endovascular Repair or Open Repair of Abdominal Aortic Aneurysms, Overall and According to Age.
Data are shown for all patients (Panel A), for those 67 to 74 years of age (Panel B), those 75 to 84 years of age (Panel C), and those 85 years of age or older (Panel D).

N Eng J Med 338:5, January 31, 2008, p. 470

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TABLE 2. PERIOPERATIVE OUTCOMES AFTER ENDOVASCULAR REPAIR OR OPEN REPAIR*

Perioperative Outcomes	Endovascular Repair (N = 22,830)	Open Repair (N = 22,830)	P Value	Relative Risk Associated with Open Repair (95% CI)
Death (% of patients)				
All ages	1.2	4.8	<0.001	4.00 (3.51-4.56)
67-69 yr	0.4	2.5	<0.001	6.21 (4.98-7.73)
70-74 yr	0.8	3.3	<0.001	4.12 (3.51-4.84)
75-79 yr	1.3	4.8	<0.001	3.69 (3.25-4.19)
80-84 yr	1.6	7.2	<0.001	4.49 (4.02-5.02)
≥ 85 yr	2.7	11.2	<0.001	4.14 (3.80-4.52)
Medical Complications (% of patients)				
Myocardial Infarction	7.0	9,4	<0.001	1.34 (1.26-1.42)
Pneumonia	9.3	17.4	<0.001	1.89 (1.79-1.98)
Acute Renal Failure	5.5	10.9	<0.001	2.00 (1.87-2.14)
Renal Failure Requiring Dialysis	0.4	0.5	0.047	1.33 (1.00-1.75)
Deep-vein Thrombosis or Pulmonary Embolism	1.1	1.7	<0.001	1.51 (1.29-1.76)
Surgical Complications (% of patients)				
Conversion to Open Repair	1.6			
Acute Mesenteric Ischemia	1.0	2.1	<0.001	2.19 (1.87-2.56)
Reintervention for Bleeding	0.8	1.2	<0.001	1.50 (1.24-1.80)
Tracheostomy	0.2	1.5	<0.001	7.46 (5.48-10.14)
Thrombectomy	0.4	0.2	<0.001	0.50 (0.35-0.71)
Embolectomy	1.3	1.7	<0.001	1.29 (1.11-1.50)
Repair of Infected Graft or Graft-enteric Fistula	0.01	0.09	<0.001	7.00 (2.09-23.46)
Major Amputation	0.04	0.13	0.002	3.00 (1.47-6.14)

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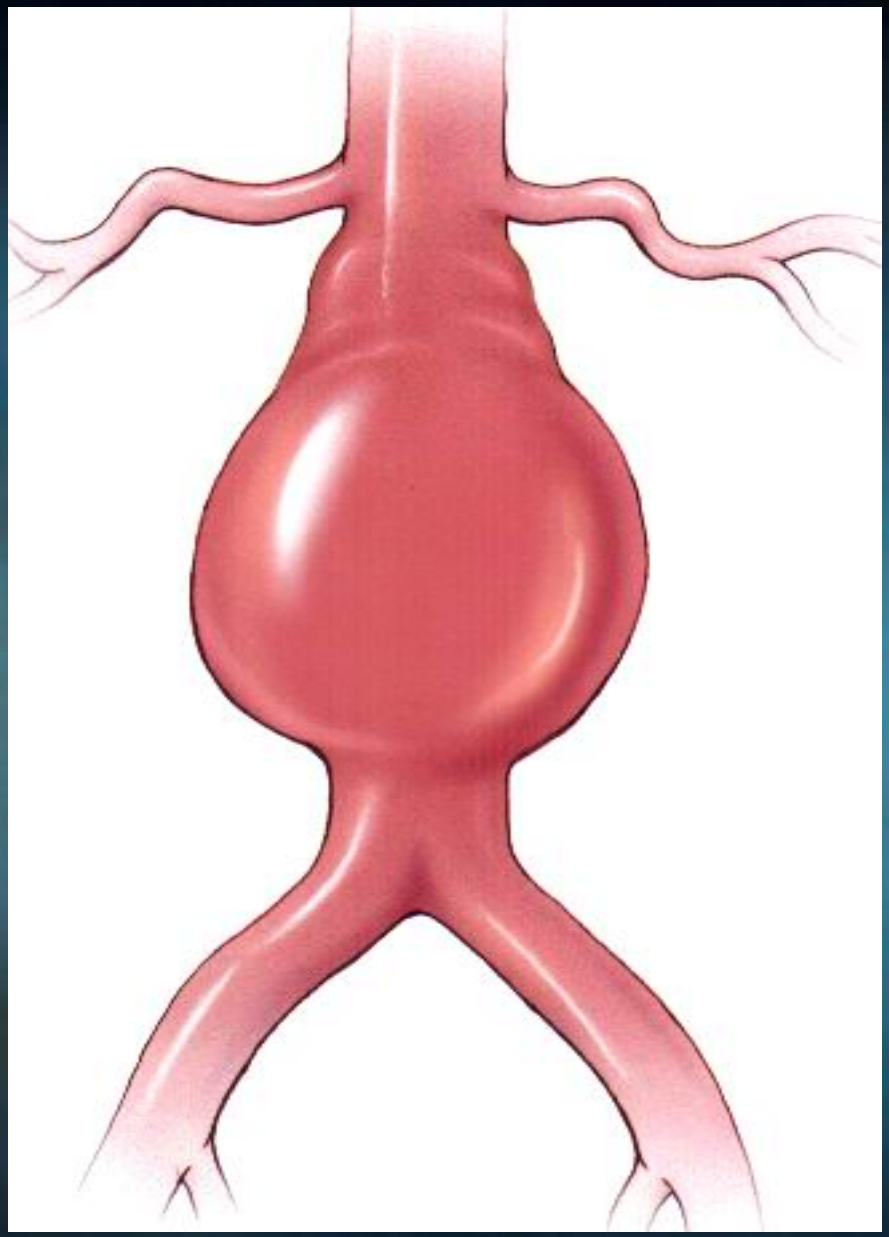
TABLE 2. PERIOPERATIVE OUTCOMES AFTER ENDOVASCULAR REPAIR OR OPEN REPAIR*

	Endovascular Repair	Open Repair	P Value	Relative Risk Associated with Open Repair
Complications Related to Laparotomy				
Lysis of Adhesions Without Resection	0.1	1.2	<0.001	13.05 (8.37-20.33)
Bowel Resection	0.6	1.3	<0.001	2.17 (1.77-2.65)
Ileus or Bowel Obstruction Without Resection or Lysis of Adhesions	5.1	16.7	<0.001	3.25 (3.05-3.46)
Mean Length of Hospital Stay (No. of Days)	(3.4±4.7)	9.3±8.3	<0.001	
Discharged Home (% of patients)				
All ages	94.5	94.5	<0.001	0.87 (0.87-0.88)
67-69 yr	97.8	97.8	<0.001	0.95 (0.95-0.95)
70-74 yr	96.8	96.8		0.92 (0.91-0.92)
75-79 yr	94.4	94.4	<0.001	0.85 (0.84-0.86)
80-84 yr	90.6	90.6	<0.001	0.75 (0.74-0.75)
≥ 85 yr	84.6	84.6	<0.001	0.67 (0.66-0.68)

* Plus-minus Values are Means± SD.

N. Eng J Med 338;5, January 31, 2008, p. 469

R. Heuser



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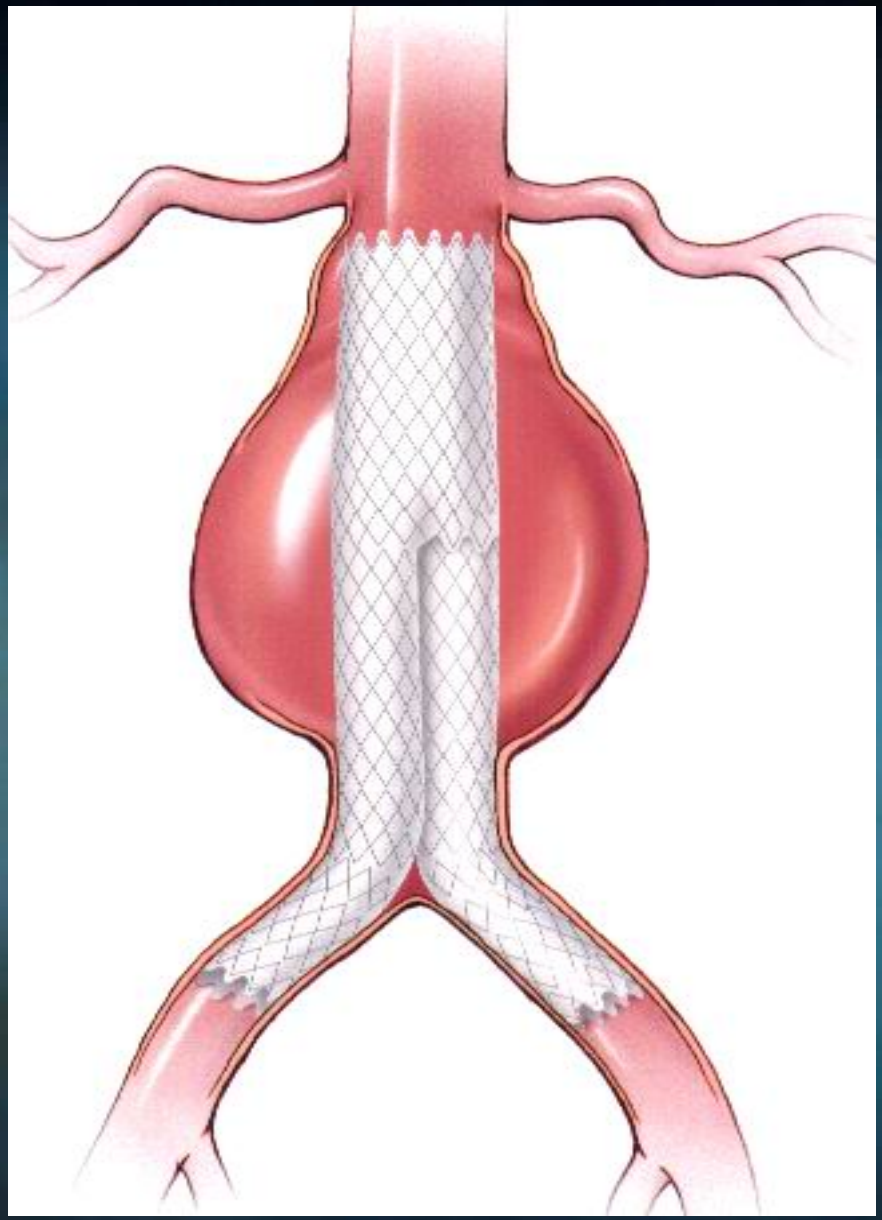

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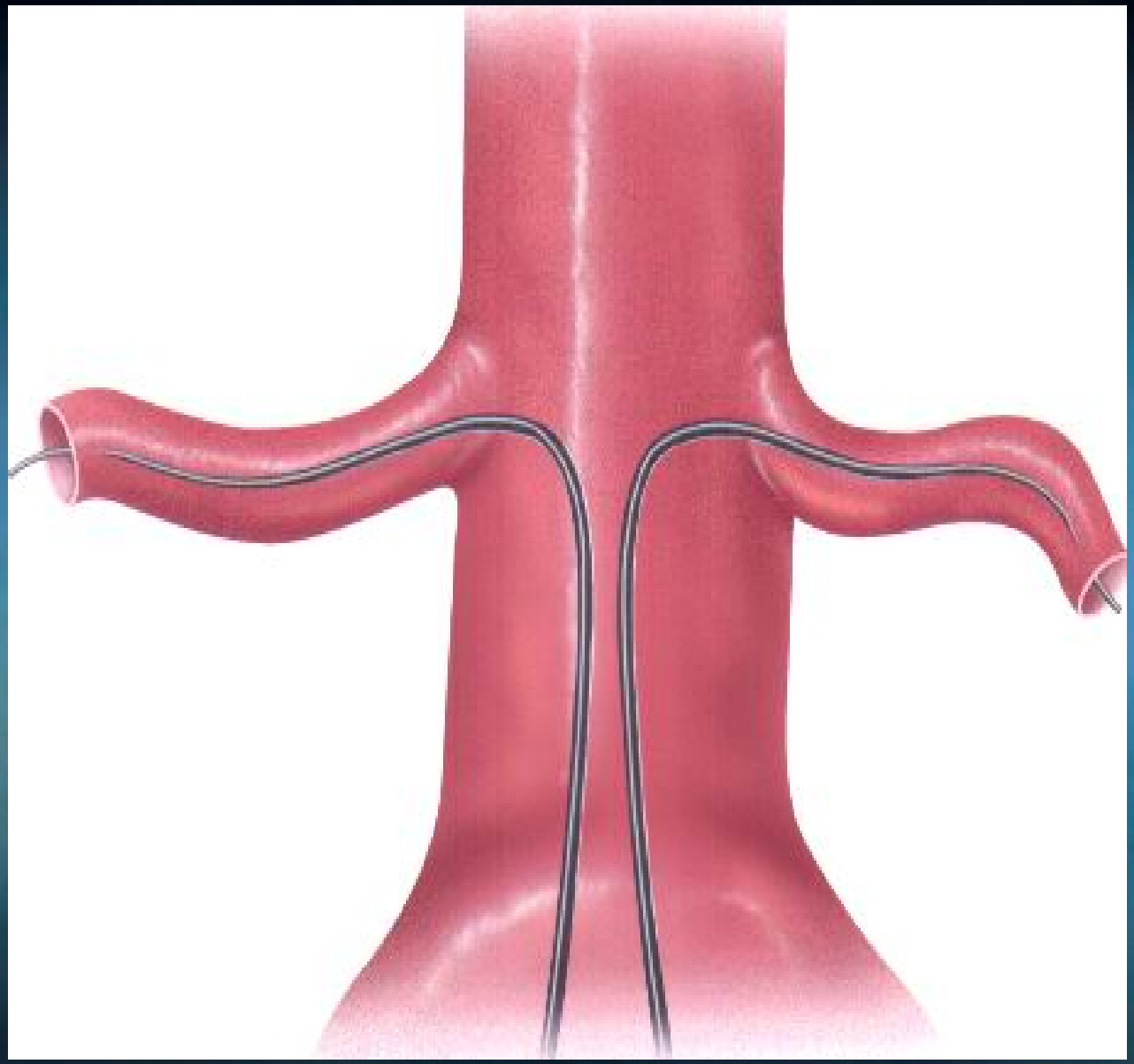

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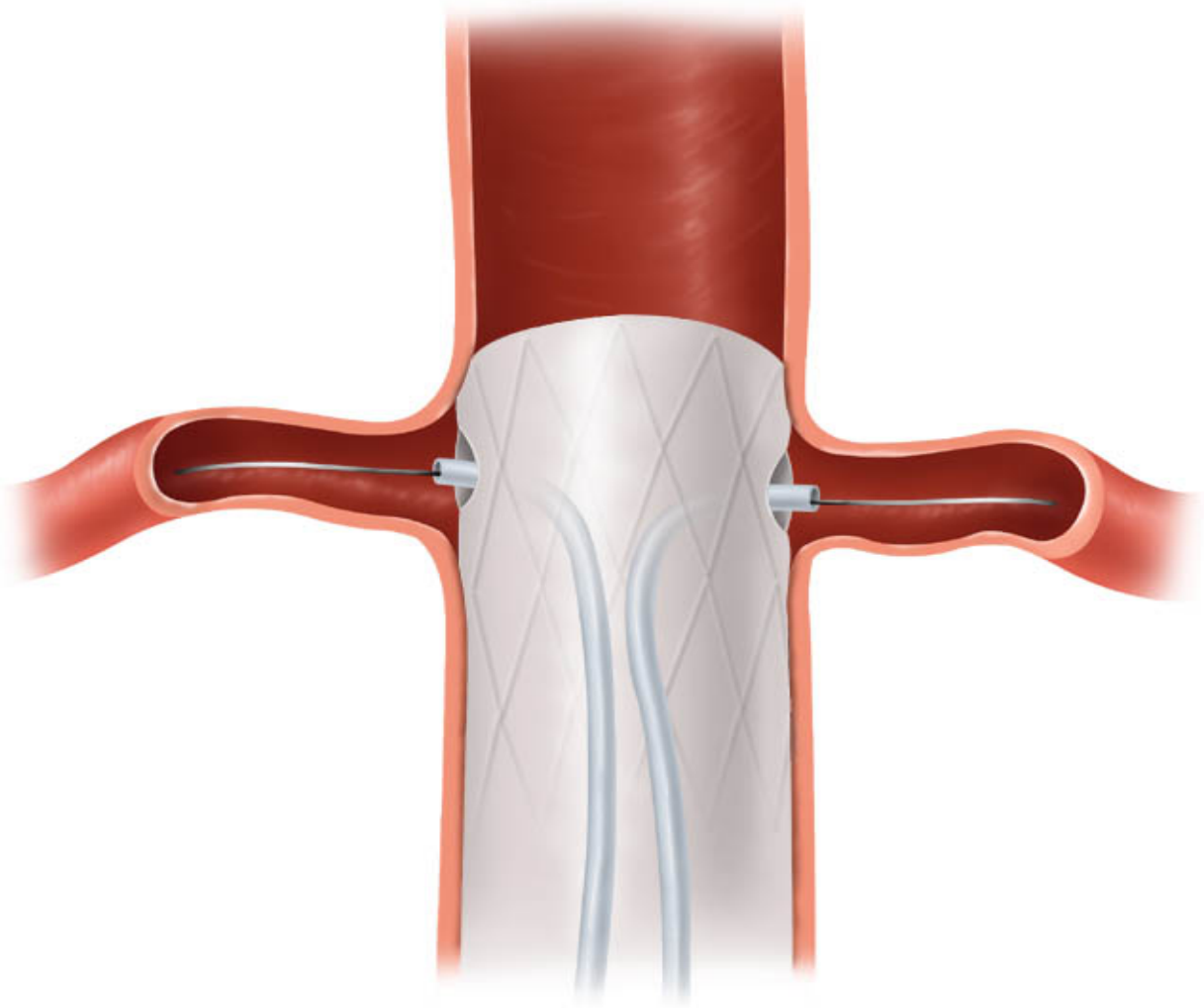

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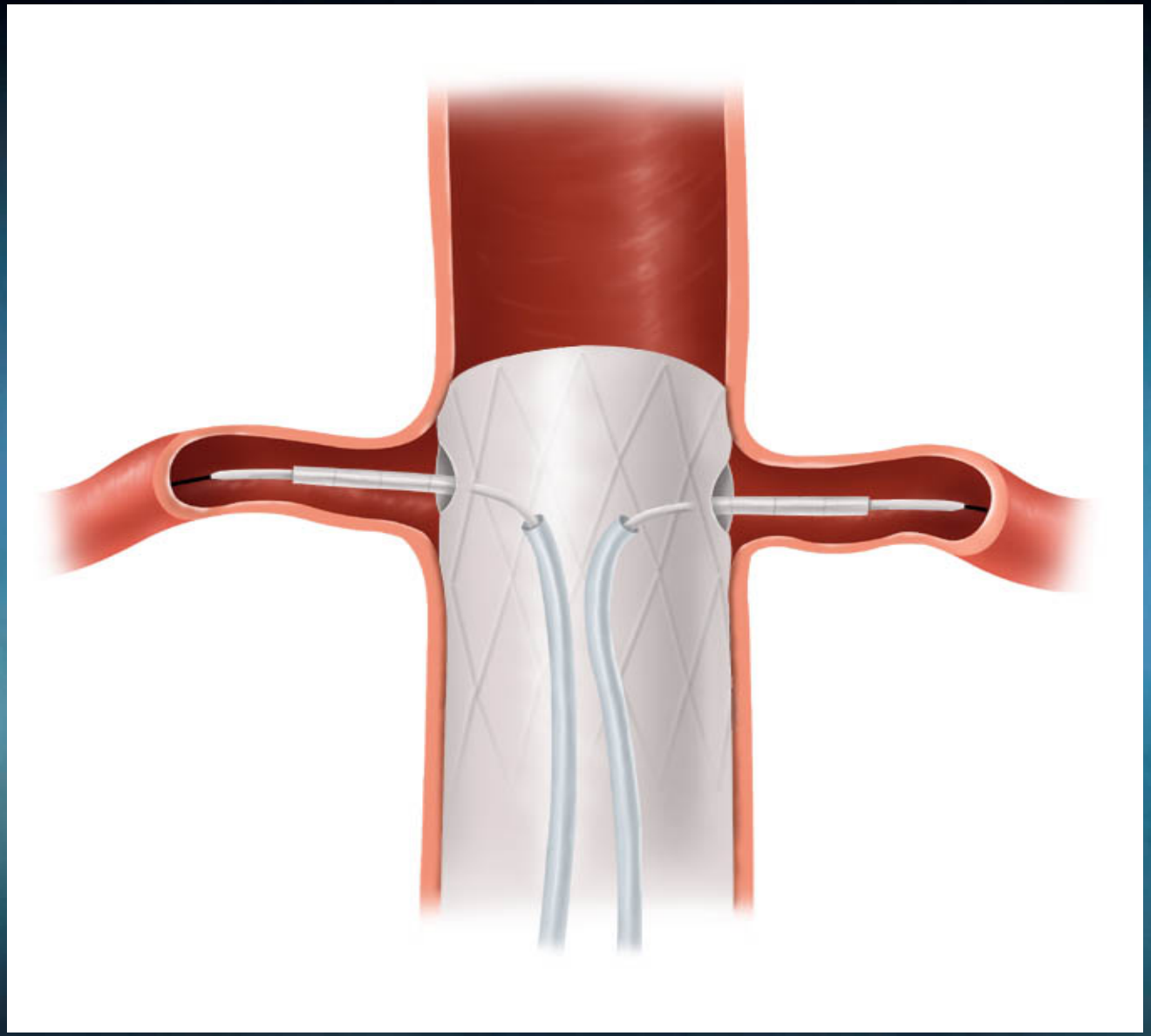

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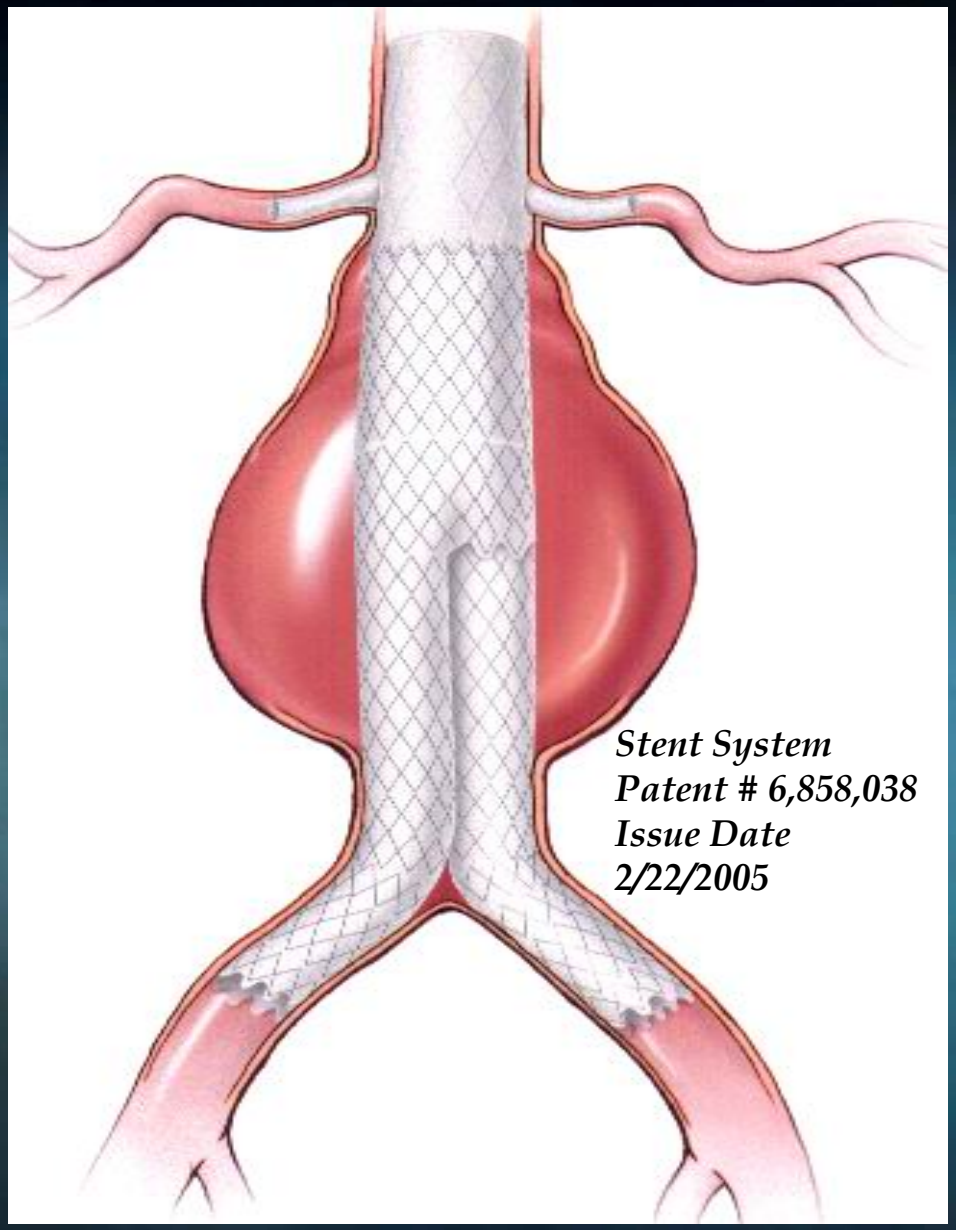

Stent System
Patent # 6,858,038
Issue Date
2/22/2005

R. Heuser

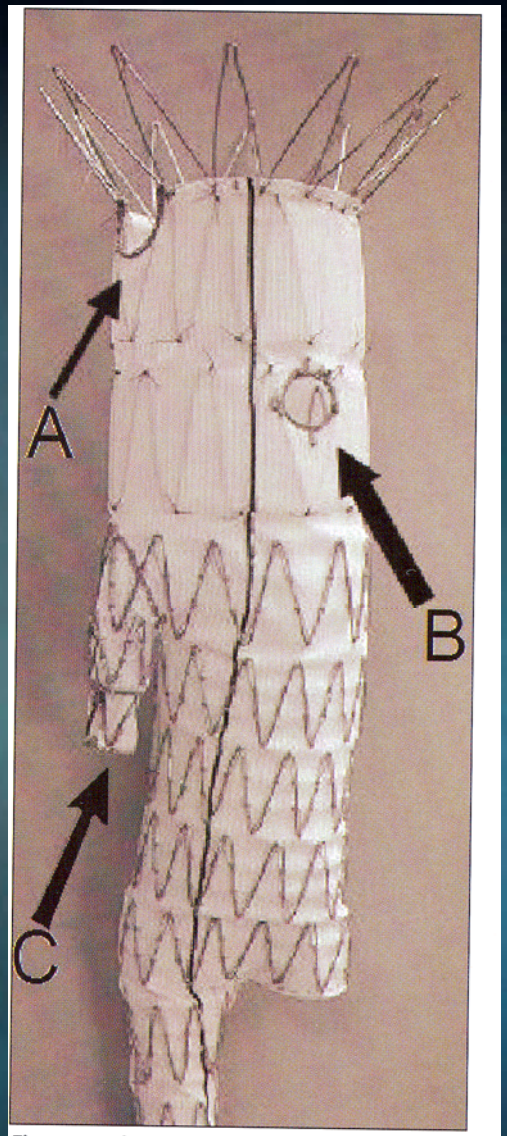

Figure 1. A branched endograft: scallop (A), small fenestration (B), and premade branch (C).

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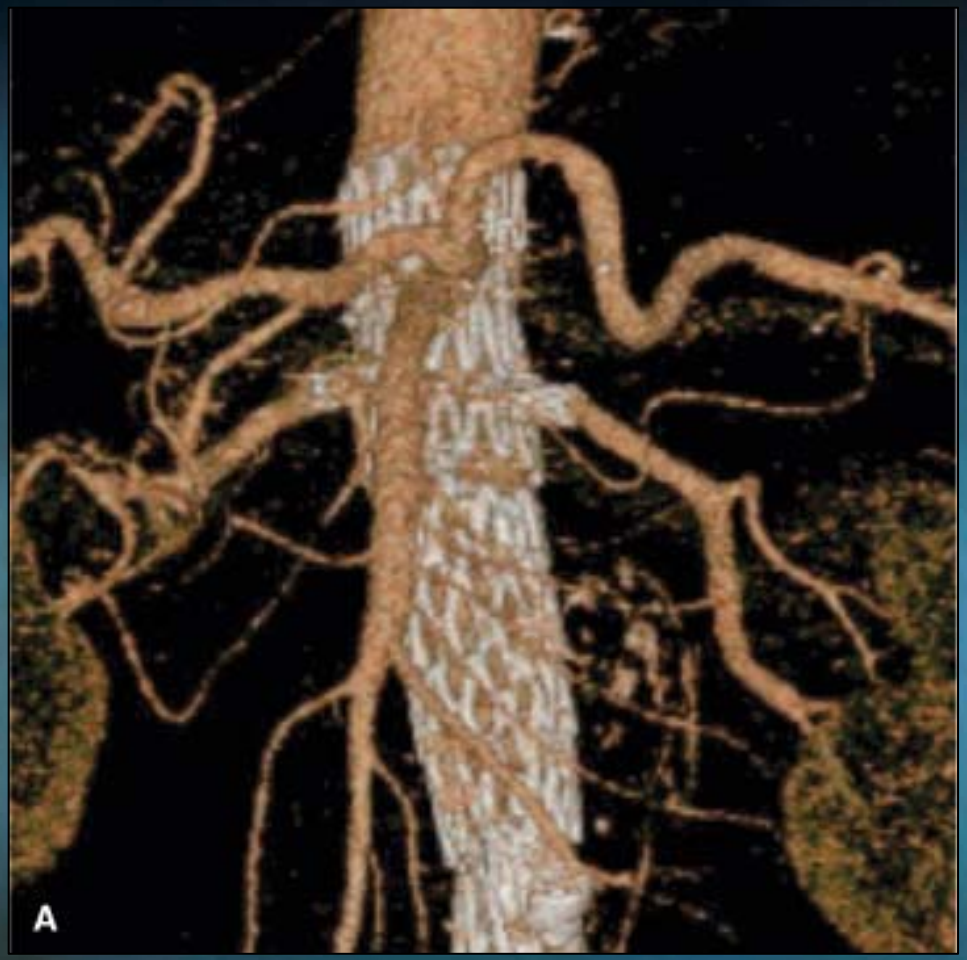
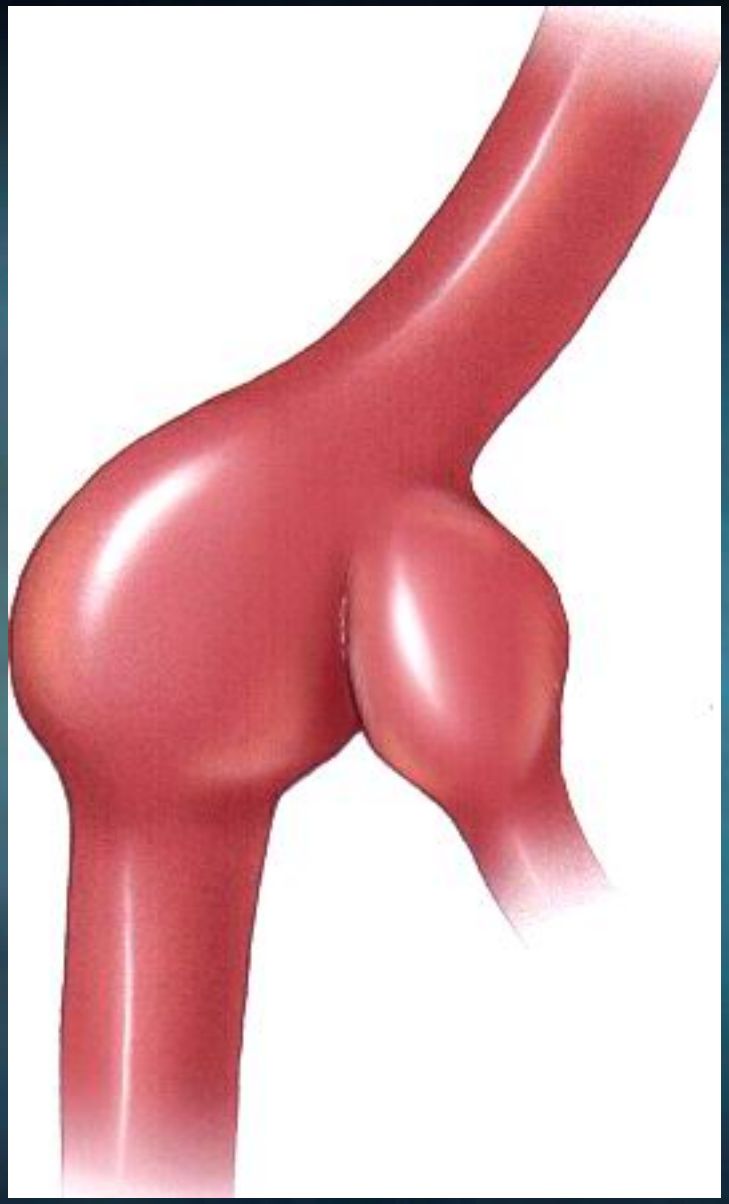


Three-dimensional reconstruction after fenestrated stent-graft with bare stents in the renal arteries. (Courtesy Dr. E. L. Verhoeven.) B, Artist's impression of branched endograft currently validated in experiment. (Courtesy Dr. W. Wisselink.)



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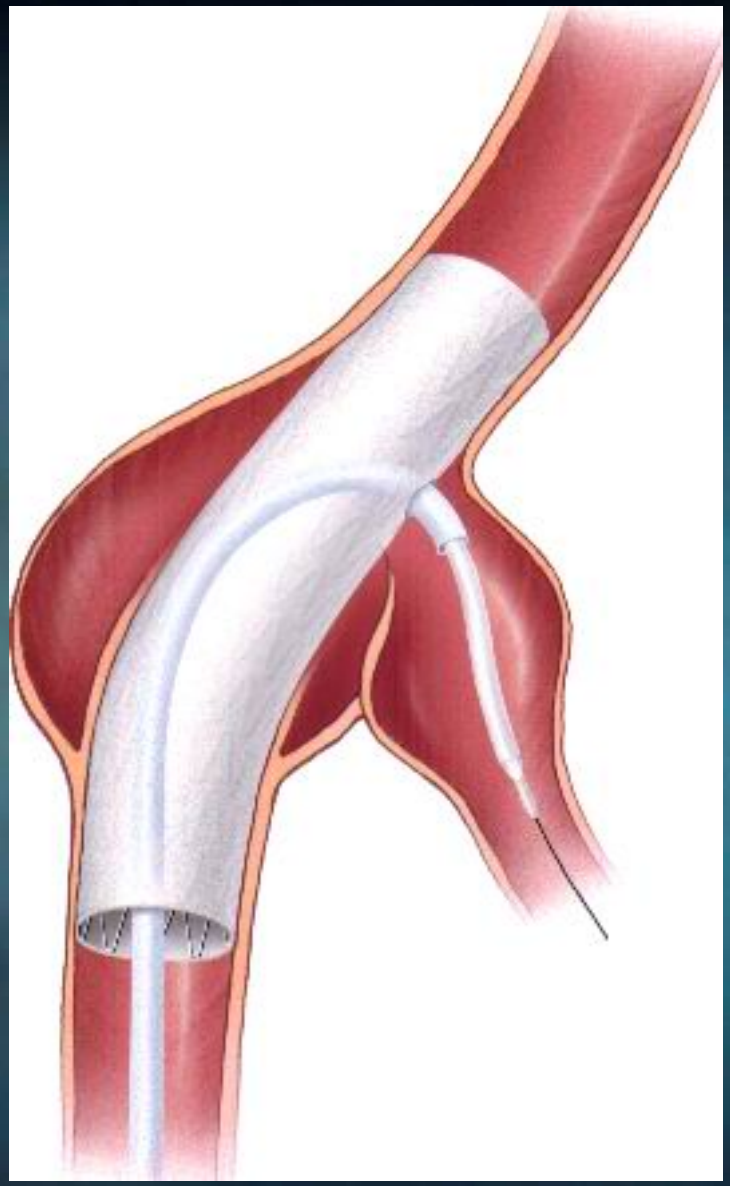

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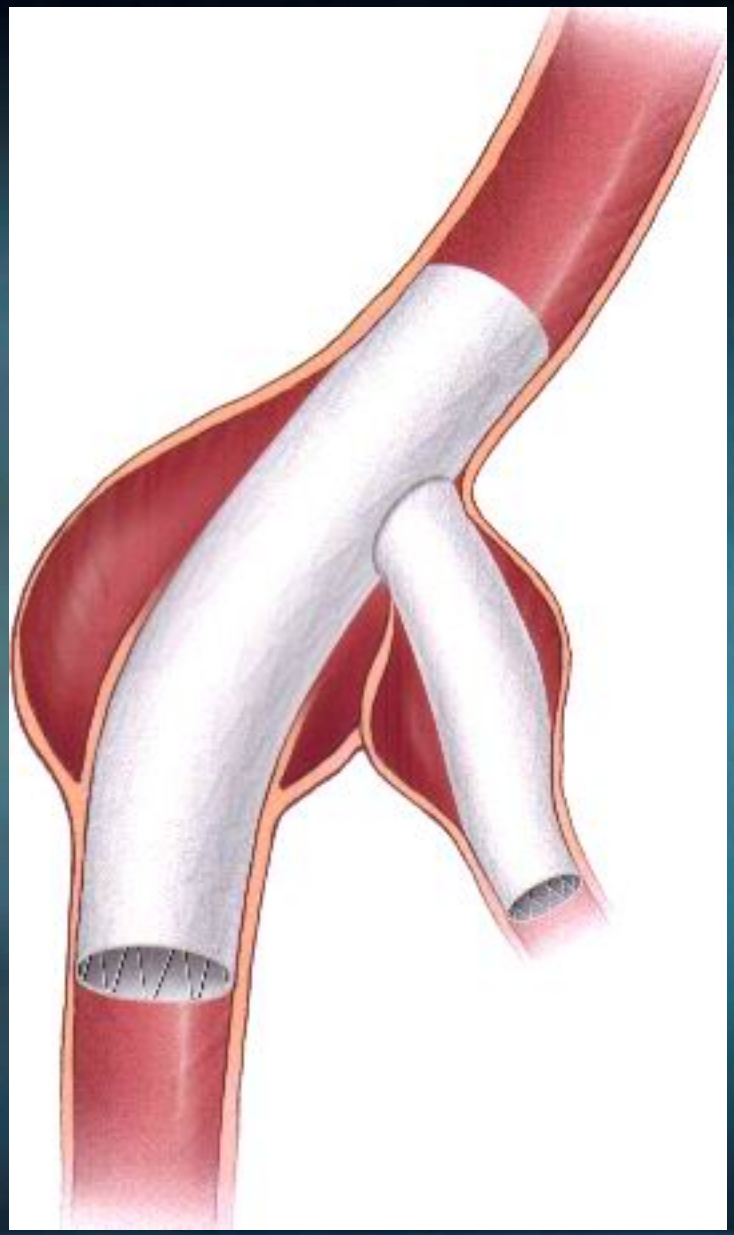

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Aneurysms

- *Can occur in any artery*
- *Most often in infrarenal abdominal aorta, accounting for 80% of all aneurysms*

Aortic Aneurysms

- *1 in 10 men by 75 years of age will have an abdominal aortic aneurysm by ultrasound*
- *Women > 80 incidence approaches that in men*
- *Women with aneurysms are more likely to rupture and die then aneurysms in men*

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Prediction

Abdominal Aortic Aneurysms can and will be able to be treated percutaneously in the Cath Lab in the near future and will no longer be exclusively the domain of the Vascular Surgeon.

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FOTOSEARCH
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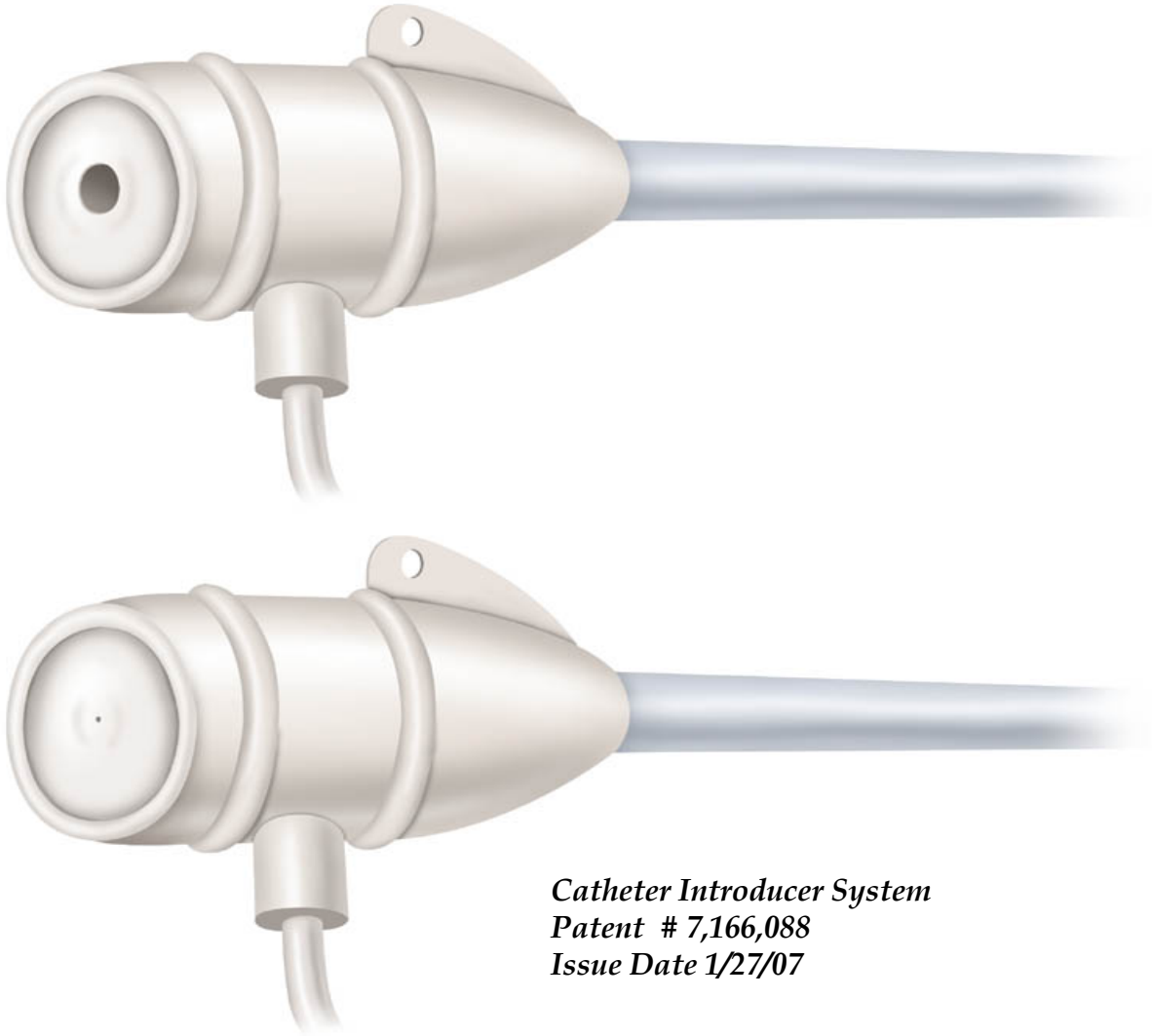

Catheter Introducer System
Patent # 7,166,088
Issue Date 1/27/07

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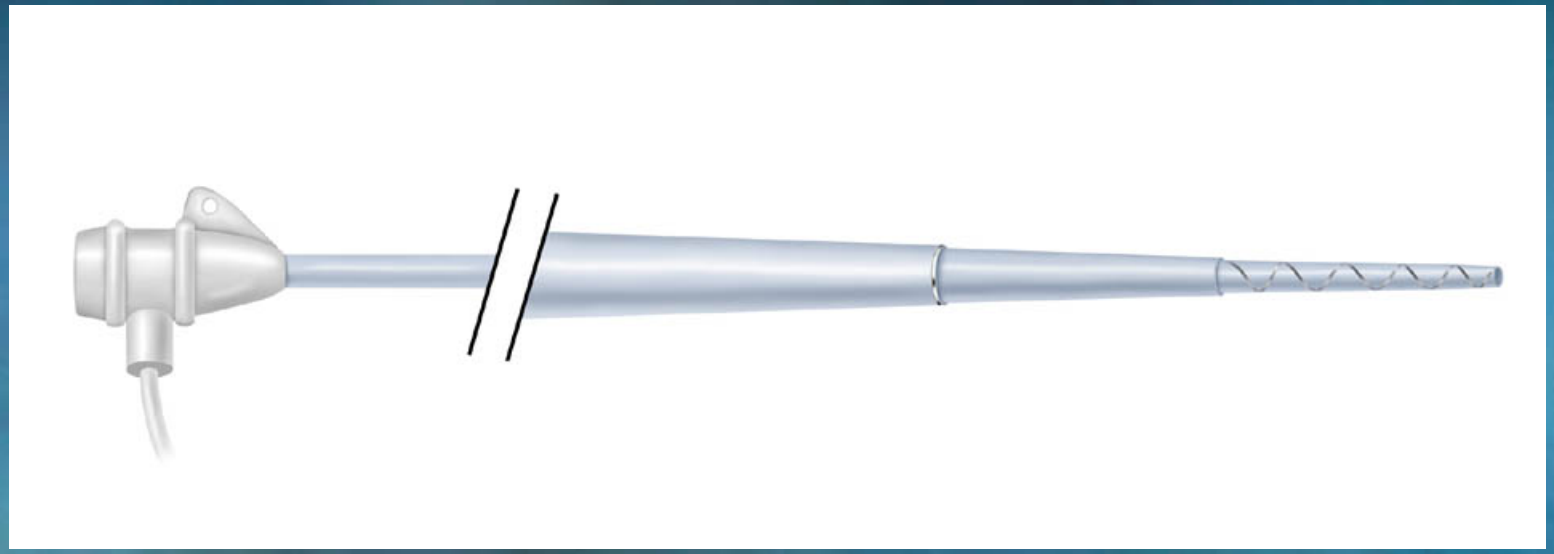

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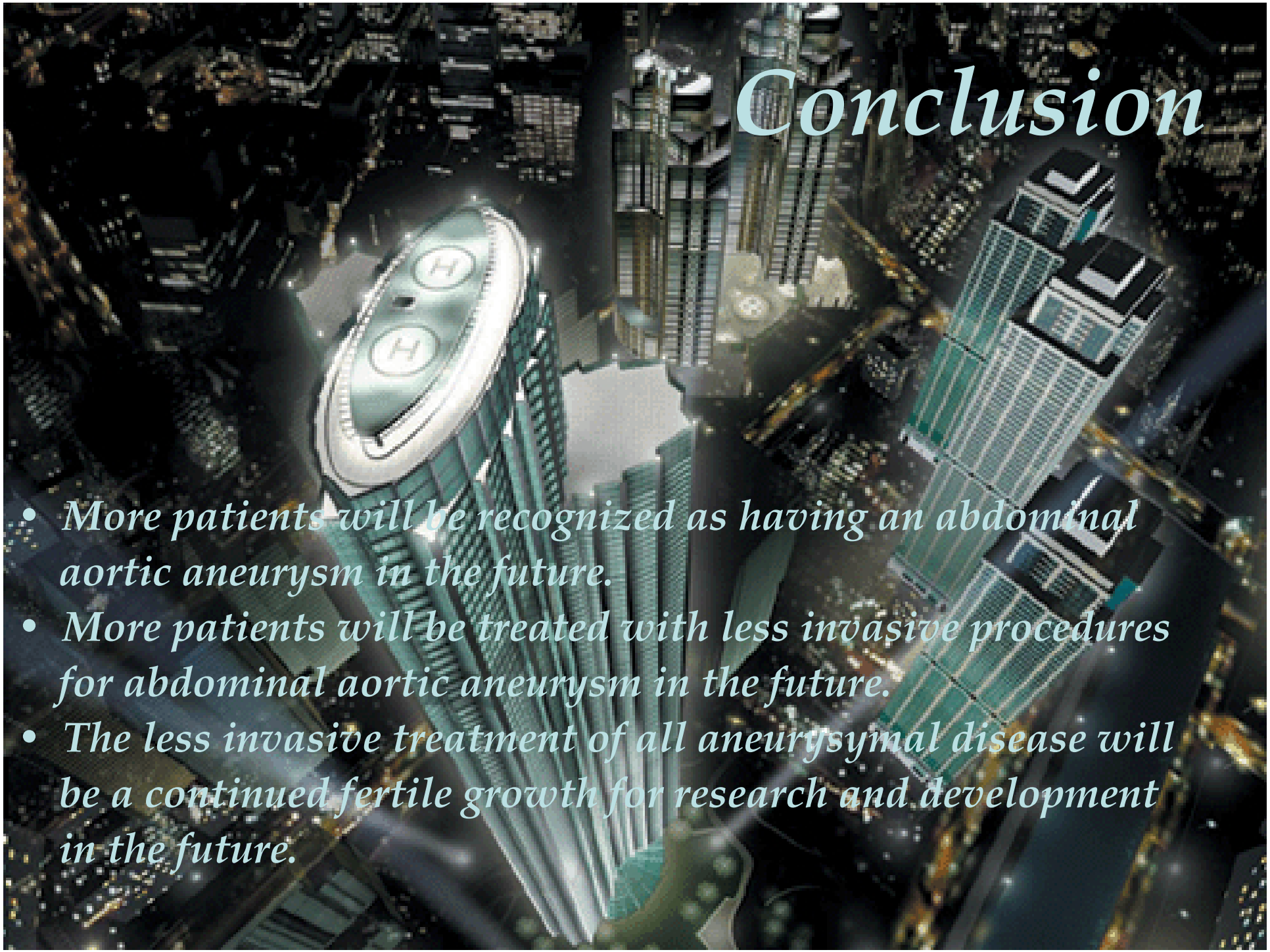

Conclusion

- *More patients will be recognized as having an abdominal aortic aneurysm in the future.*
- *More patients will be treated with less invasive procedures for abdominal aortic aneurysm in the future.*
- *The less invasive treatment of all aneurysmal disease will be a continued fertile growth for research and development in the future.*

Aneurysms

- *aneurysm is derived from the Greek word aneurysma meaning "a widening"*
- *an aneurysm is defined as a permanent localized dilation of an artery having at least a 50% increase in diameter compared with the expected normal diameter*
- *dilation <50% is termed ectasia*

Aneurysms History

- *A description of traumatic aneurysms of the peripheral arteries in the Ebers Papyrus (2000 B.C.)*
- *Antyllus in 2nd century AD recommended ligating the artery above and below and evacuating the contents*
- *Brachial artery false aneurysms common complication of blood letting*

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Aortic Aneurysms

- *13th leading cause of death in the United States*
- *15,000 deaths from rupture per year*

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Aortic Aneurysms

- *Incidence has increased fourfold 9/1000 to 37/1000*
- *Same time period deaths from stroke and MI decreased 30-40%*

Abdominal Aortic Aneurysm

- *Proclivity for lower extremities aneurysms*
- *3.5% have other aneurysms (femoral/popliteal)*
- *Likewise if peripheral aneurysm look for abdominal aortic aneurysm*

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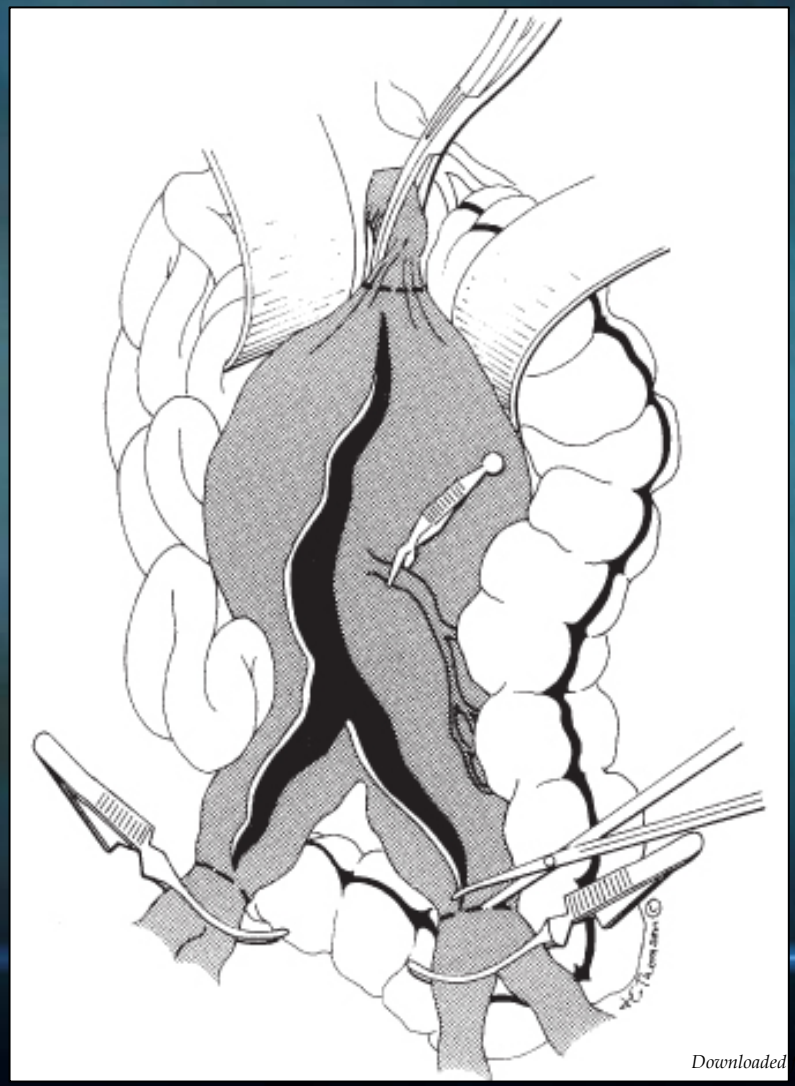
Aneurysms

Minimally Invasive Approaches

- *Thrombose with electric current between needles stuck into the vessel 1832-1930's*
- *1864 steel wires into the aneurysms (up to 26 yards)*
- *Wrap in cellophane*

  (Einstein had this done in 1949 for a symptomatic abdominal aortic aneurysm)

Transabdominal aortic aneurysm exposure, vascular clamps in place, incising the aneurysm.



Aneurysms

- *1st successful open aortic aneurysm repair was in 1951 by Norman Freeman using an autogenous iliac vein graft*
- *Charles Dubost used an aortic homograft to replace the aneurysm*

Table 100-3 Independent Risk Factors for Operative Mortality After Elective Abdominal Aortic Aneurysm Repair

RISK FACTOR	ODDS RATIO*	95% CI
Creatinine >1.8 mg/dL	3.3	1.5-7.5
Congestive heart failure	2.3	1.1-5.2
ECG ischemia	2.2	1-5.1
Pulmonary dysfunction	1.9	1-3.8
Older age (per decade)	1.5	1.2-1.8
Female gender	1.5	0.7-3

*Odds ratio indicates relative risk compared with patients without that risk factor.
CI, confidence interval.

From Steyerberg EW, Kievit J, Alexander de Mol Van Otterloo JC, et al: Perioperative mortality of elective abdominal aortic aneurysm surgery: A clinical prediction rule based on literature and individual patient data. Arch Intern Med 155:1998, 1995.

The UK Small Aneurysm Trial Participants

Mortality results for randomized controlled trial of early elective surgery or ultrasonographic surveillance for small abdominal aortic aneurysms

The UK Small Aneurysm Trial Participants The Lancet 352, November 21, 1998

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The UK Small Aneurysm Trial Participants

- *1090 patients*
- *4.0 - 5.5 cm aneurysms*
- *Followed 4.6 years*

The UK Small Aneurysm Trial Participants

- *Mortality*
- *30 day 5.8% surgical group*
- *No difference at 2, 4, 6 years*

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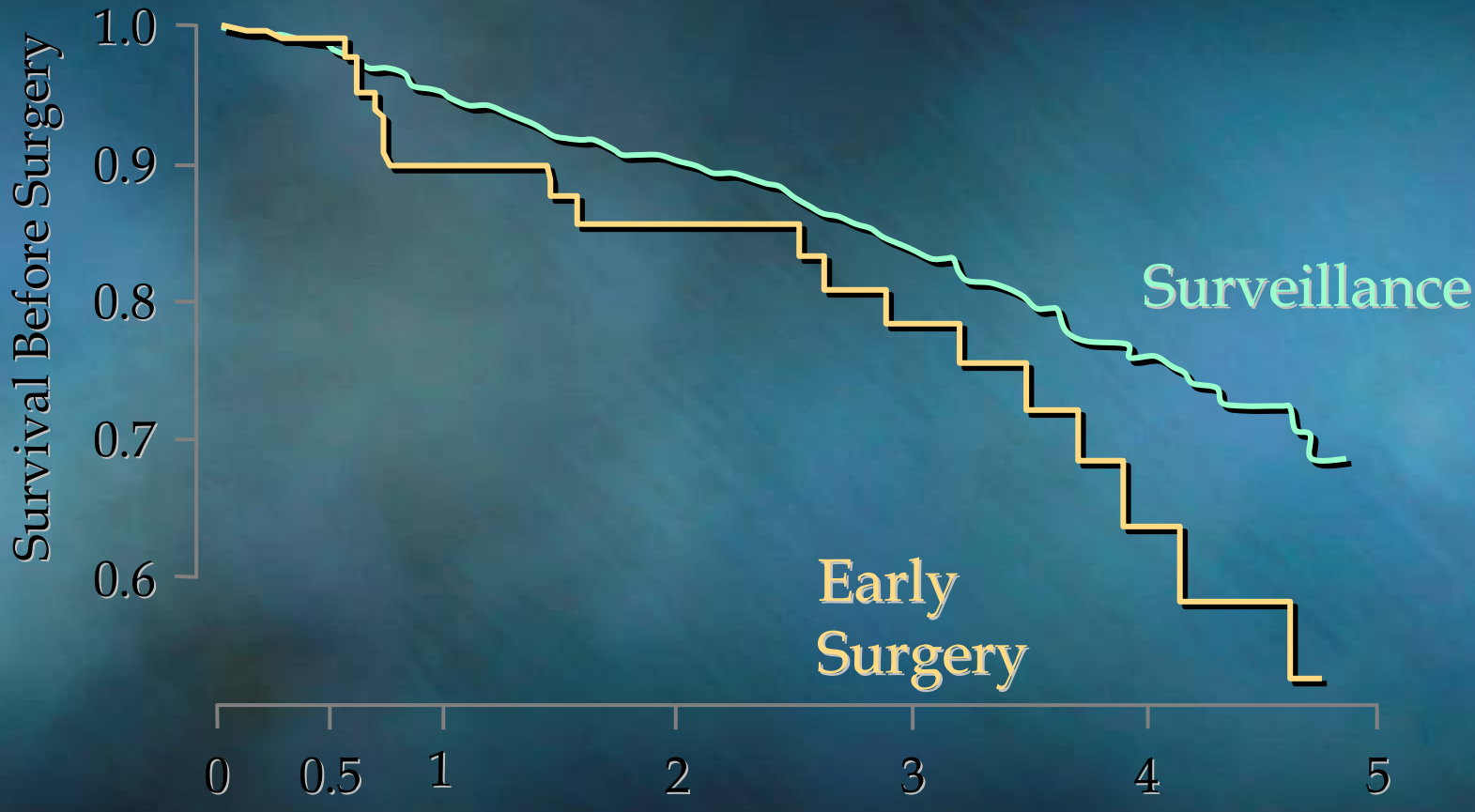
Survival by Randomized Treatment Group, up to Time of Surgery



Number at Risk

Surveillance	527	484	409	292	197	77	29
Early Surgery	563	91	54	38	32	14	9

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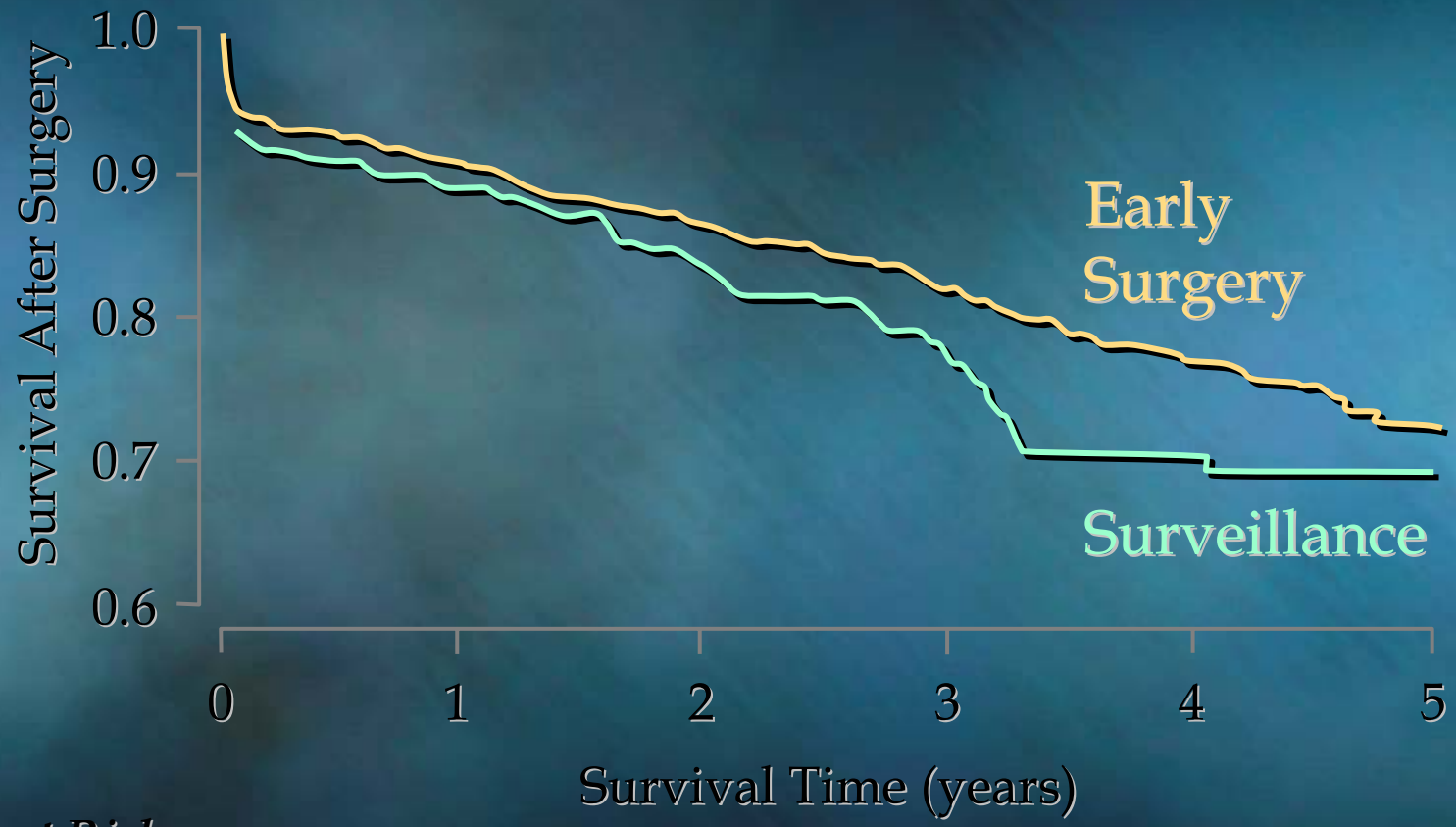
Survival by Randomized Treatment Group, After Time of Surgery



Number at Risk

Surveillance	321	241	182	117	60	28
Early Surgery	520	471	448	385	263	149

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Cardiovascular Deaths	Deaths in Surveillance Group (n=150)	Deaths in early surgery group (n=159)
Total	105	94
Myocardial Infarction	30	24
Stroke	7	5
Ruptured Thoracic Aneurysm	6	2
Ruptured AAA*	17	6
After AAA Repair†	18	26
Other Cardiovascular Deaths	27	31

***Ten (43%) of 23 ruptured AAA had diameter >5.5 cm †Underlying cause of death, within 14 days of operative repair ‡Patient died abroad, cause of death not known.**

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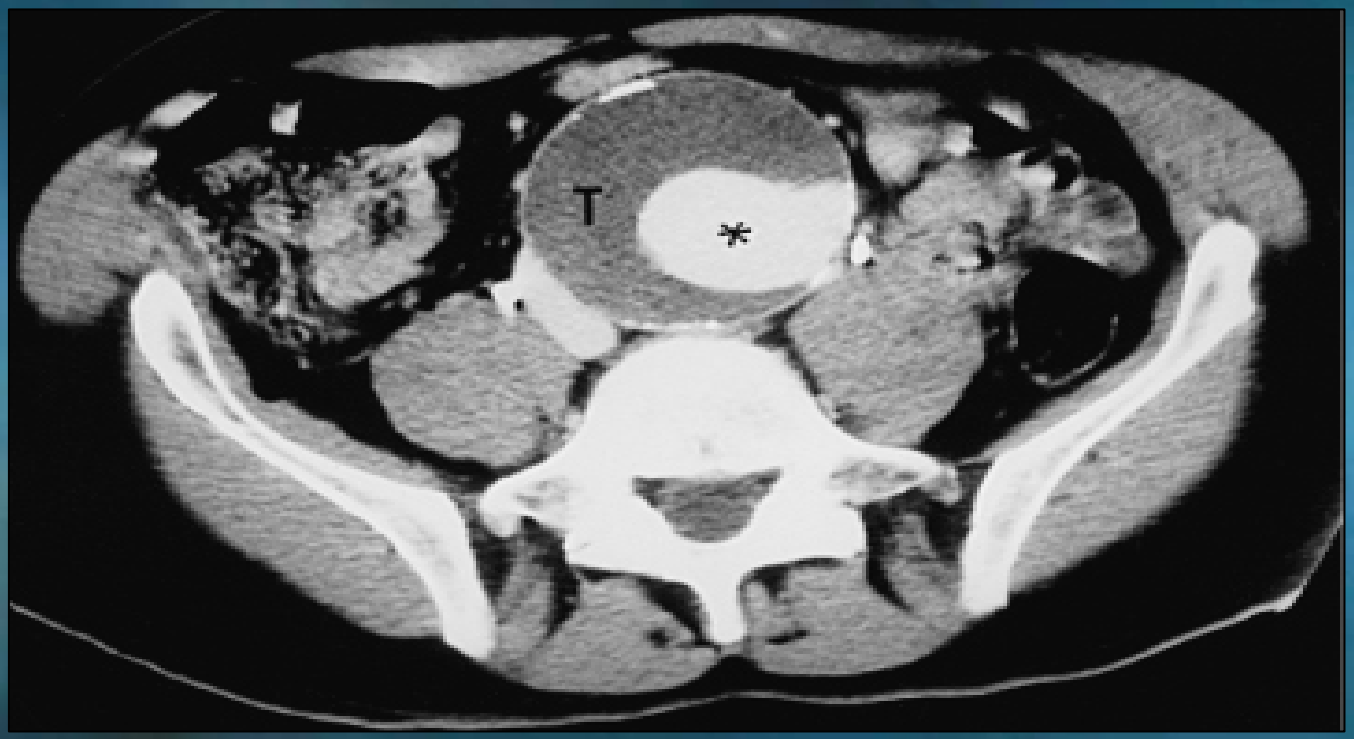

CT scan of abdominal aortic aneurysm shows contrast-filled lumen (*) surrounded by thrombus (T) within the aneurysm sac.

Angiotensin-converting enzyme inhibitors and aortic rupture: a population-based case-control study

Daniel G Hackam, Deva Thiruchelvam, Donald A Redelmeier

Summary

Background Angiotensin-converting enzyme (ACE) inhibitors prevent the expansion and rupture of aortic aneurysms in animals. We investigated the association between ACE inhibitors and rupture in patients with abdominal aortic aneurysms.

Methods We did a population-based case-control study of linked administrative databases in Ontario, Canada. The sample included consecutive patients older than 65 (n=15 326) admitted to hospital with a primary diagnosis of ruptured or intact abdominal aortic aneurysm between April 1, 1992, and April 1, 2002.

Findings Patients who received ACE inhibitors before admission were significantly less likely to present with ruptured aneurysm (odds ratio [OR] 0·82, 95% CI 0·74–0·90) than those who did not receive ACE inhibitors. Adjustment for demographic characteristics, risk factors for rupture, comorbidities, contraindications to ACE inhibitors, measures of health-care use, and aneurysm screening yielded similar results (0·83, 0·73–0·95). Consistent findings were noted in subgroups at high risk of rupture, including patients older than 75 years and those with a history of hypertension. Conversely, such protective associations were not observed for β blockers (1·02, 0·89–1·17), calcium channel blockers (1·01, 0·89–1·14), α blockers (1·15, 0·86–1·54), angiotensin receptor blockers (1·24, 0·71–2·18), or thiazide diuretics (0·91, 0·78–1·07).

Interpretation ACE inhibitors are associated with a reduced risk of ruptured abdominal aortic aneurysm, unlike other antihypertensive agents. Randomised trials of ACE inhibitors for prevention of aortic rupture might be warranted.

Lancet 2006;368:659-65

R. Heuser

Aortic Aneurysm Rupture

- *50% will die prior to getting medical help*
- *Contained rupture patients easiest to treat*
- *Mortality for repair of ruptured aortic aneurysms 50-90%*

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Abdominal Aortic Aneurysm Rupture

Annual Risk of Rupture

- ***< 5 cm 1-2%***
- ***5-6 cm 10%***
- ***> 6 cm 25%***

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DR. RICHARD HEUSER
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- *Minimally invasive surgery*
- *Reduced morbidity and ?mortality*
- *Less blood loss/need for transfusion*
- *Shorter hospital stay*
- *Quicker recovery time*

Patient Preferred Treatment

R. Heuser

BUSINESS/FINANCIAL DESK | June 17, 2003, Tuesday

Medical Concern Will Halt Sales Of Artery Device Linked to Deaths

By MELODY PETERSEN (NYT) 746 words

Late Edition - Final , Section C , Page 1 , Column 5

ABSTRACT - Guidant Corp to stop selling device that helps treat weakened abdominal aorta after admitting it concealed thousands of problems linked to product; says 18,000 patients who already have device are safe because problems center on system used to insert it, not device itself; says it will continue to support those patients over years; group chairman Jay Graf says potential liability from dozen suits filed on behalf of patients who died or were injured by device is 'manageable' because product liability insurance will help pay costs (M)

Potential Endoluminal Graft Complications

- *Dissection/Perforation*
- *Device malfunction/failure*
- *Thromboembolic Event*
- *Prosthetic Occlusion*
- *Prosthetic Migration*
- *Prosthetic Leak*
- *Limb Ischemia*
- *Ischemic Bowel*
- *Renal Failure*
- *Wound Infection*
- *Coagulopathy*
- *MI*
- *Arrythmias*

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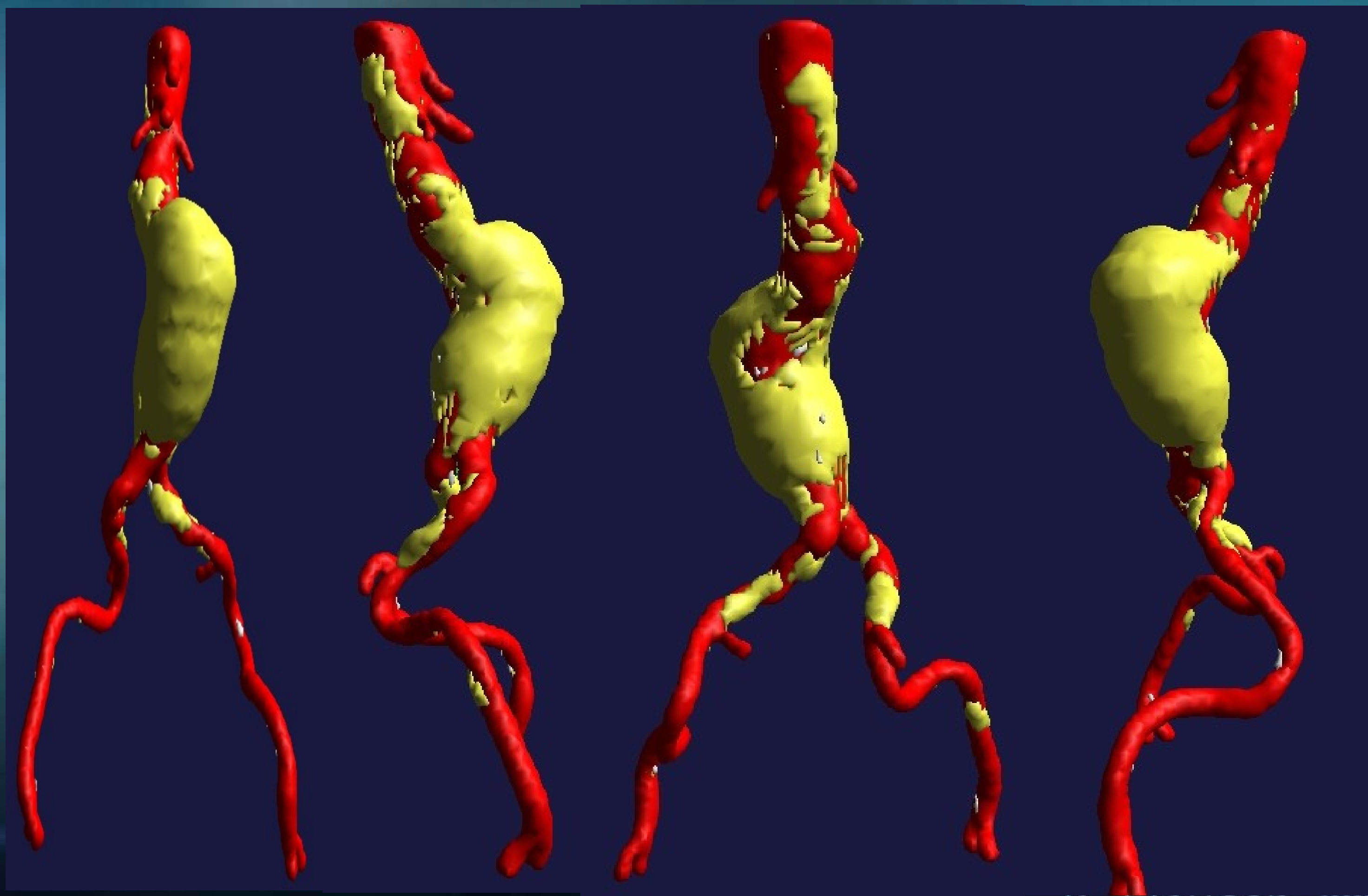
Early Clinical Evaluation



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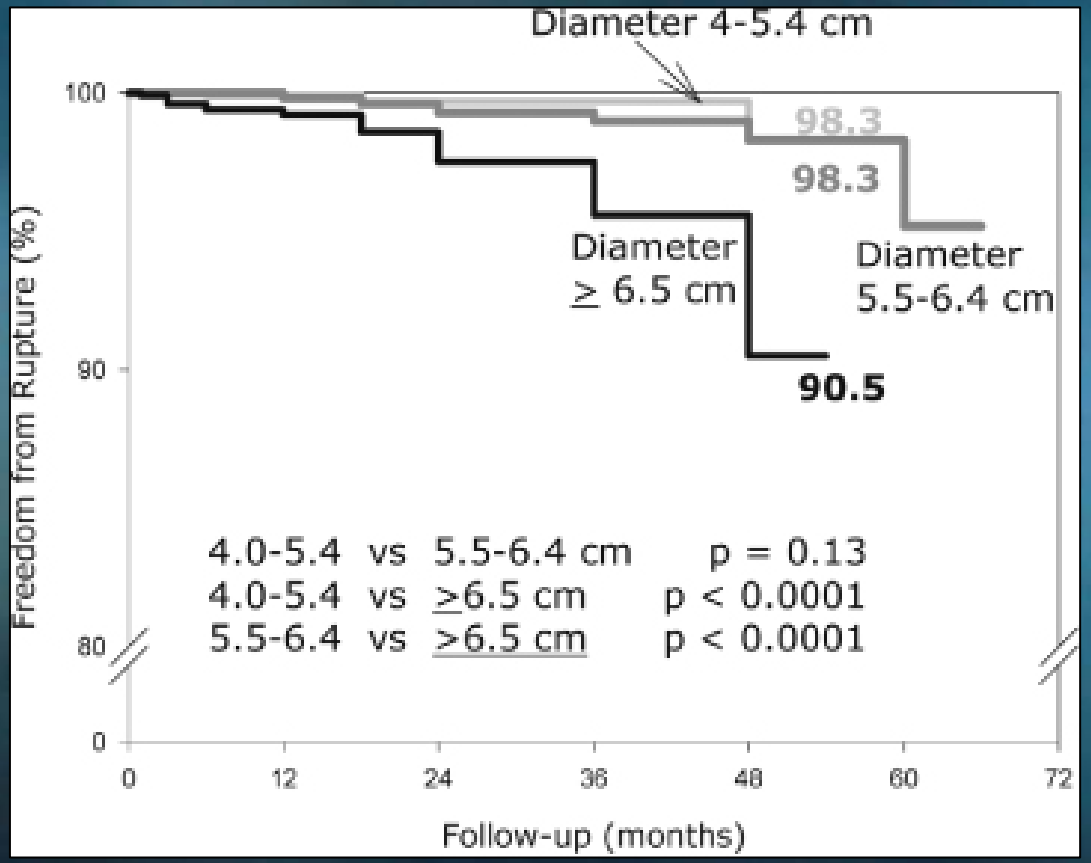

Cumulative freedom from rupture after endovascular aneurysm repair in patients with aneurysms measuring 4 to 5.4 cm, 5.5 to 6.4 cm, and more than 6.5 cm. (From Ouriel K, Clair DG, Greenberg RK, et al: Endovascular repair of abdominal aortic aneurysms: Device-specific outcome. J Vasc Surg 37:991-998, 2003.)

EVAR Trial

- *Patients* **900**
- *Over Recruited* **1082**
- *EVAR* **543**
- *Open Repair* **539**

Lancet 2004;364;843-8

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EVAR Trial

- *30 Day Mortality*
- *EVAR* *1.7%*
- *Open* *4.7%* *P<.05*

Lancet 2004;364;843-8

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Dream Trial

***D**utch **R**andomized **E**ndovascular*
***A**neurysm*
***M**anagement Trial Group*

- *EVAR* 171
- *Open* 174

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Dream Trial

Operative Mortality

- *EVAR* *1.2%*
- *Open* *4.6%* *P=.10*

Severe Complications

- *EVAR* *11.7%* *P<.001*
- *Open* *26.4%*

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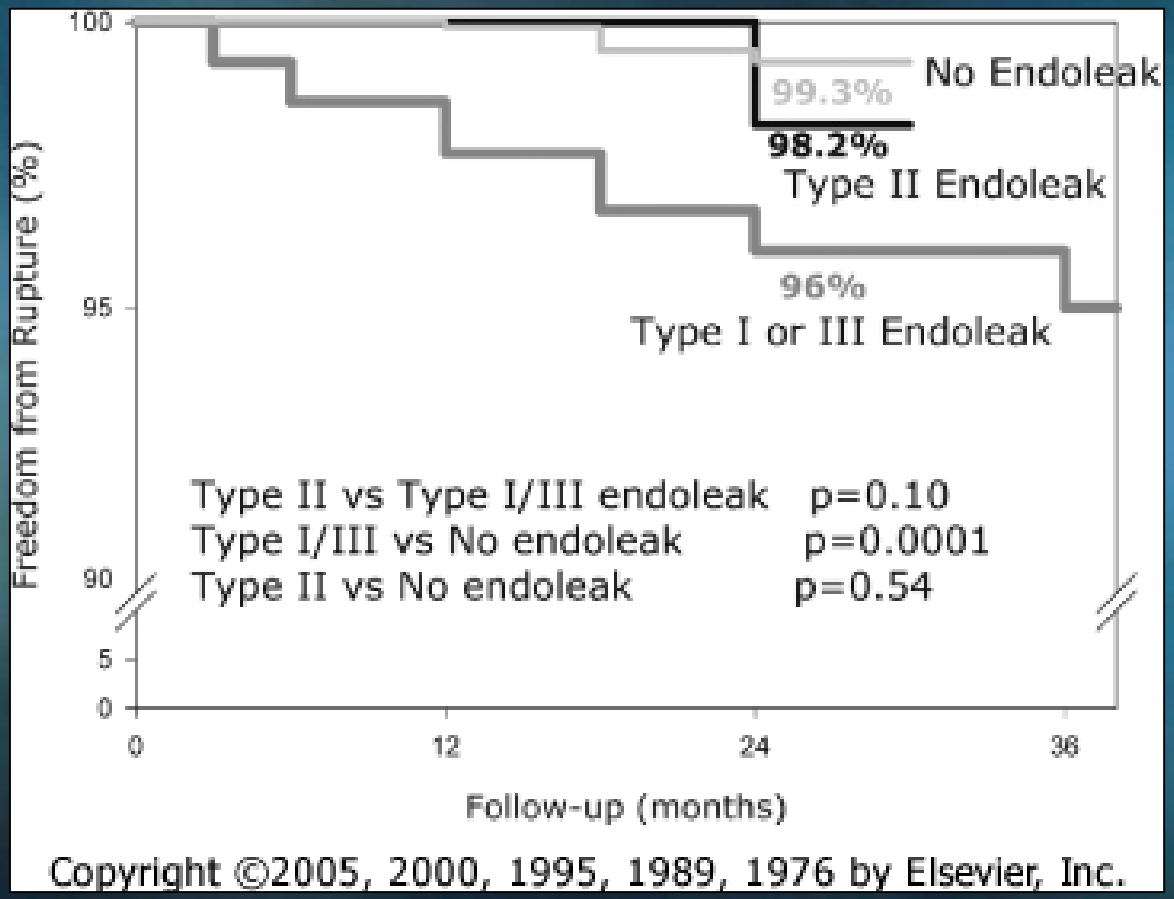
TYPES, ETIOLOGY, AND TREATMENT OF ENDOLEAKS

Type	Etiology	Treatment
1	Attachment Site	PTA, Balloons, Stents
2	Collaterals	Embolization
3	Graft Failure	Graft Repair
4	Pourosity	No Treatment Needed



Freedom from aneurysm rupture after endovascular aneurysm repair in patients categorized according to endoleak: with isolated type II endoleak, with type I or type III endoleak, and without endoleak.
(From Van Marrewijk C, Buth J, Harris PL, et al: Significance of endoleaks after endovascular repair of abdominal aortic aneurysms: The EUROSTAR experience. J Vasc Surg 35:461-473, 2002.)

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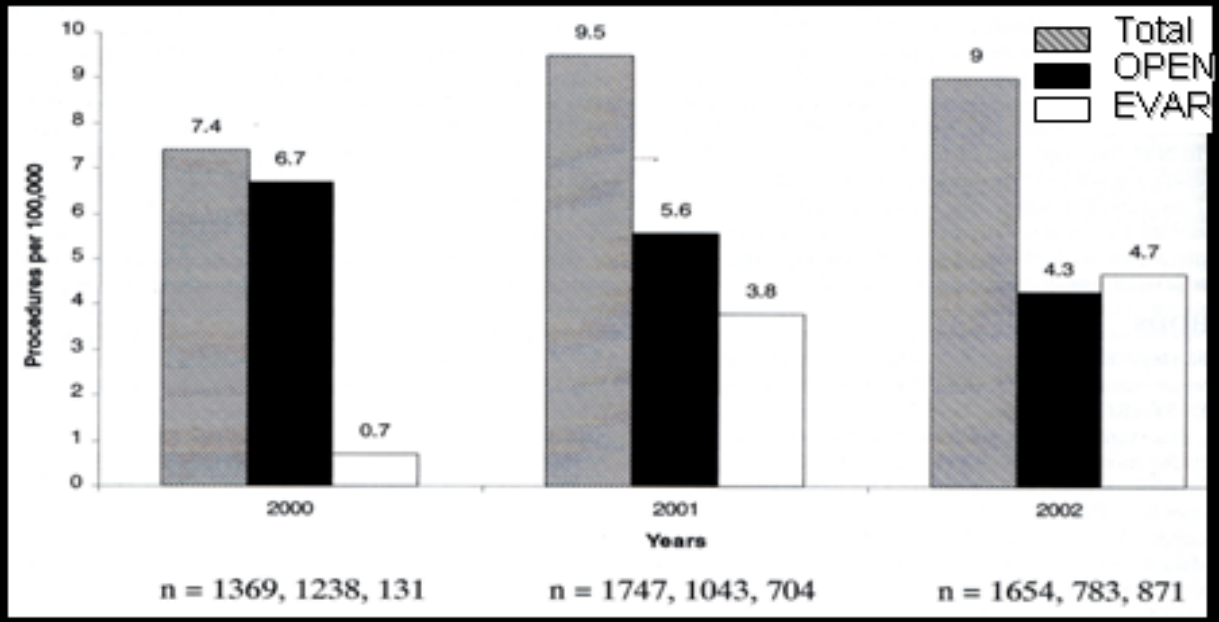
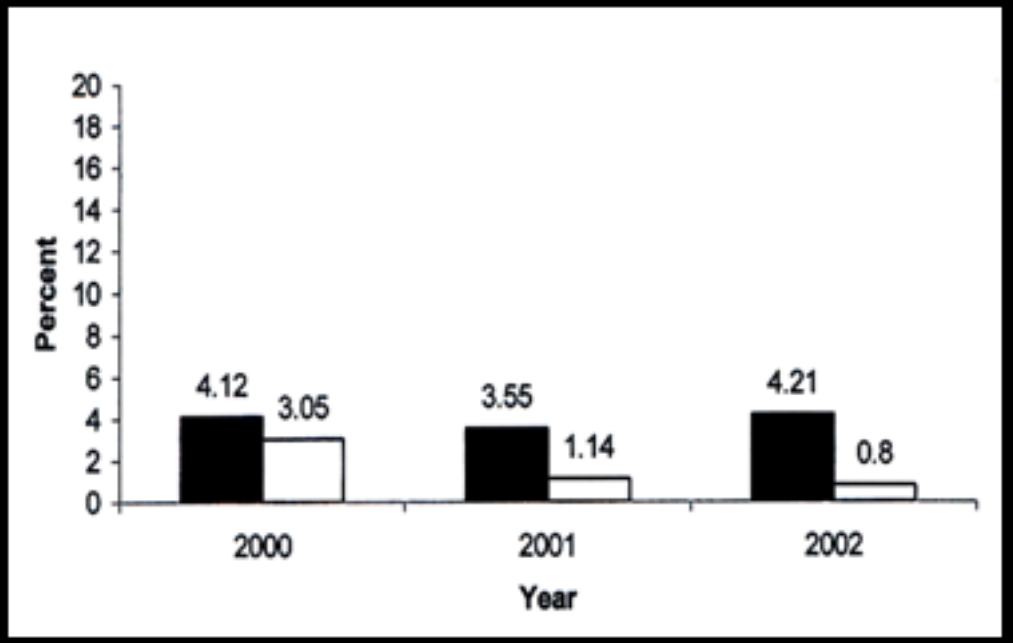
PER CAPITA AAA REPAIR IN THE STATE OF NEW YORK



*Anderson PL, et al. A statewide experience with endovascular aortic aneurysm repair: Rapid diffusion with excellent results. J Vasc Surg 2004; 39:10-19.

HOSPITAL MORTALITY IN ELECTIVE AAA REPAIR*



*Anderson PL, et al. A statewide experience with endovascular aortic aneurysm repair: Rapid diffusion with excellent results. J Vasc Surg 2004; 39:10-19.

ANALYSIS OF PRIMARY ENDPOINTS *[N=2904 Endografts]*

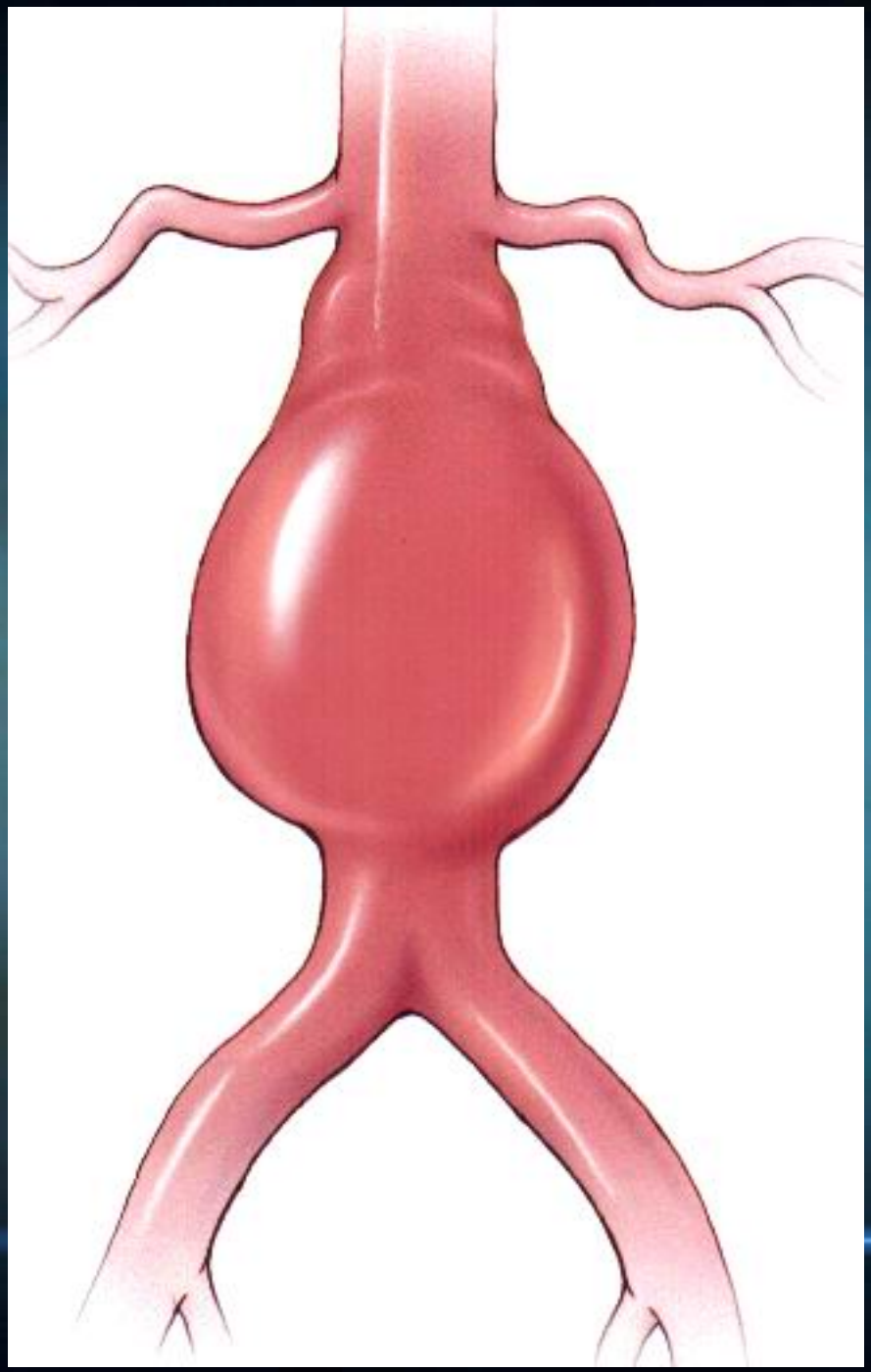
Freedom From	1 year	2 years	3 years	4 years	5 years	6 years
Death	92%	85%	80%	74%	66%	52%
AAA death	98%	98%	98%	98%	98%	98%
Rupture	100%	99%	99%	99%	99%	99%
Surgical conversion	97%	97%	97%	96%	95%	95%

Lifeline Aneurysm Registry J. Vasc. Surg (J. Vasc. Surgery-In Press)

PROCEDURAL RESULTS
(N=2904)

	EG	SC	P-value
Surgery duration (min)	183±86 (33-780)	196±84 (57-498)	0.0283
Hospital stay (days)	3.2±5.2 (0-119)	8.6±10 (0-114)	<0.0001
ICU stay (days)	0.9±2.5 (0-42)	2.2±5.9 (0-57)	0.0014
Procedure success (%)	98.1% (1599/1630)	N/A	N/A
Additional segments (%)	9.2% (148/1611)	N/A	N/A

Lifeline Aneurysm Registry J. Vasc. Surg. (In Press)



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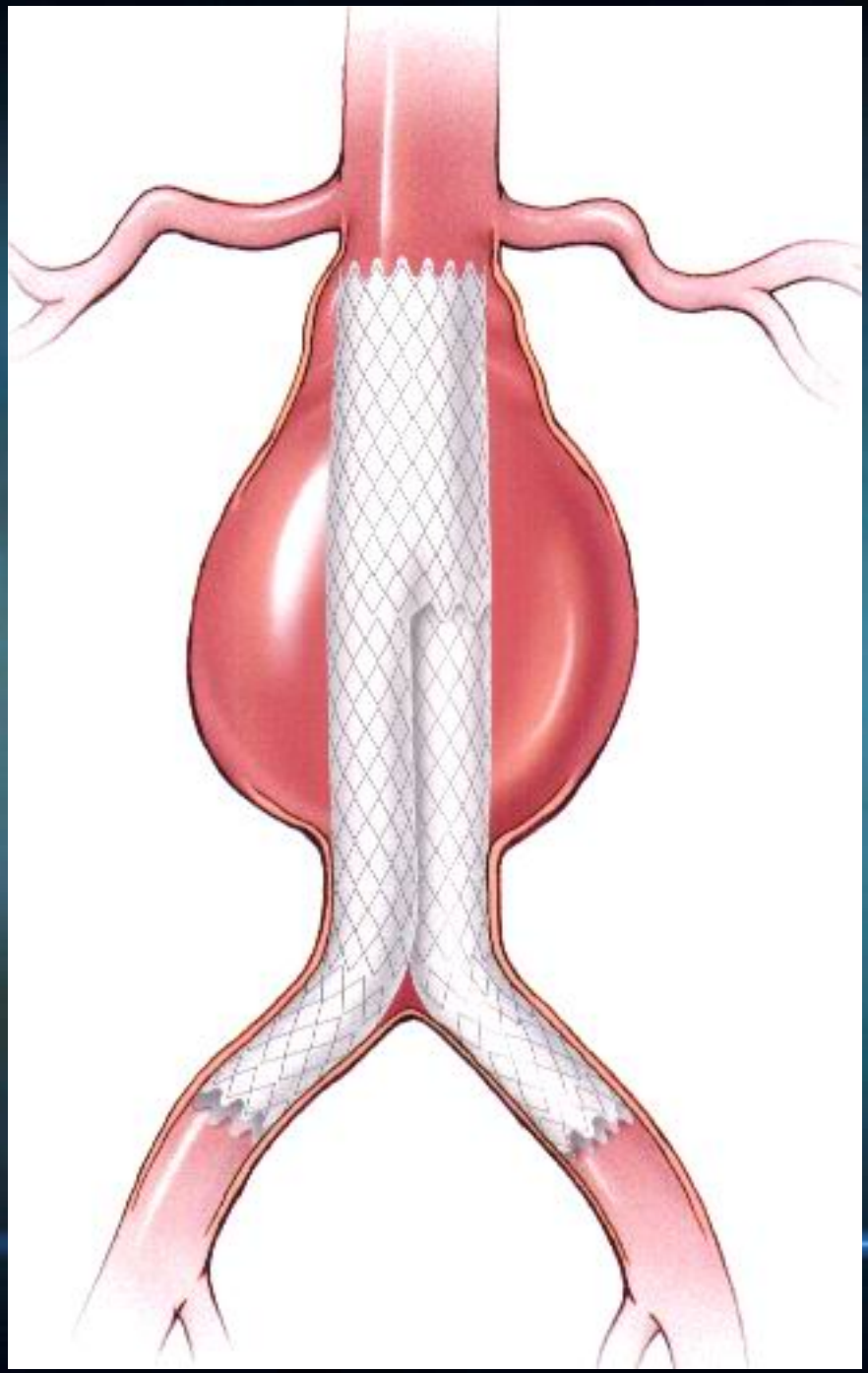

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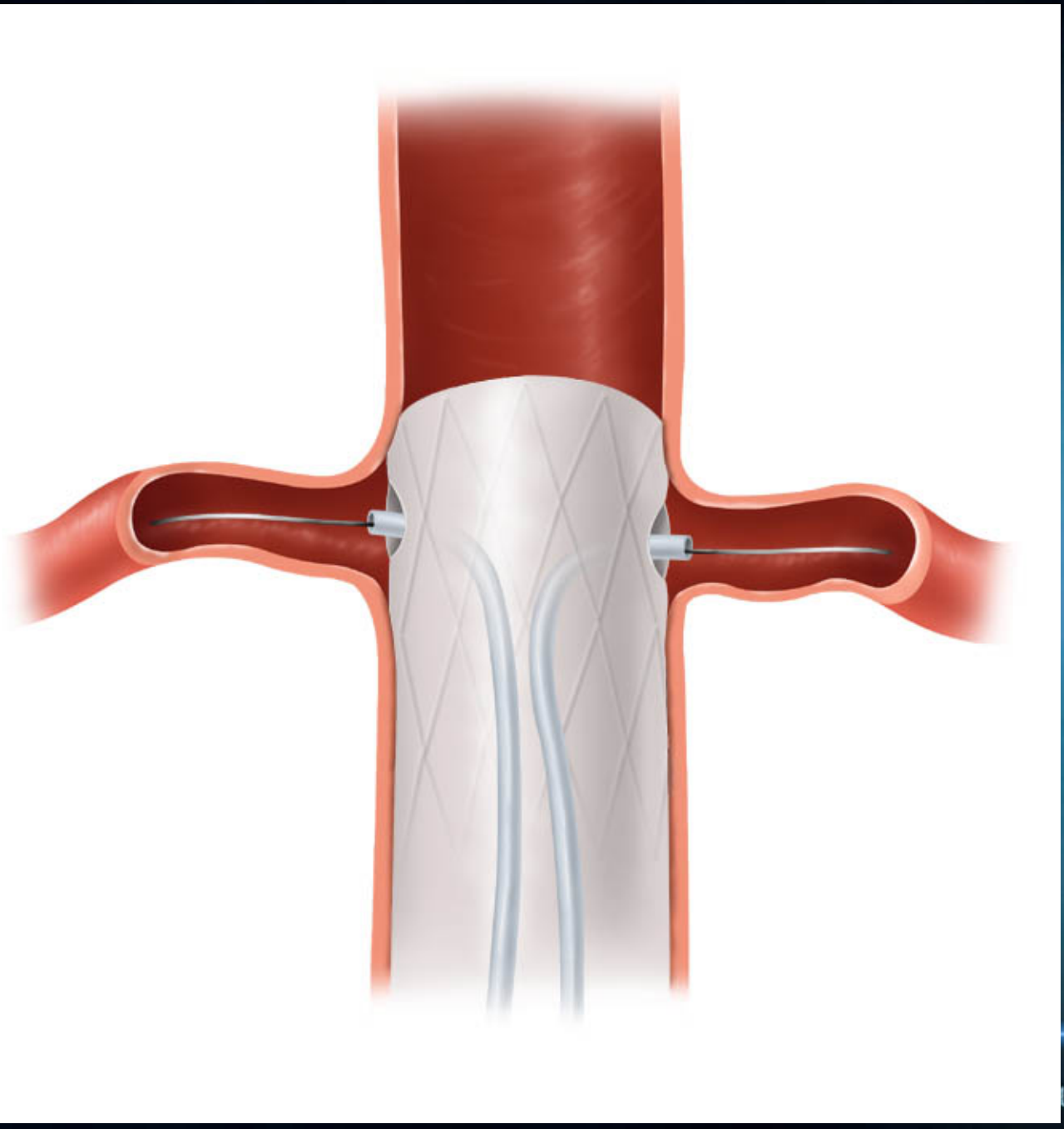
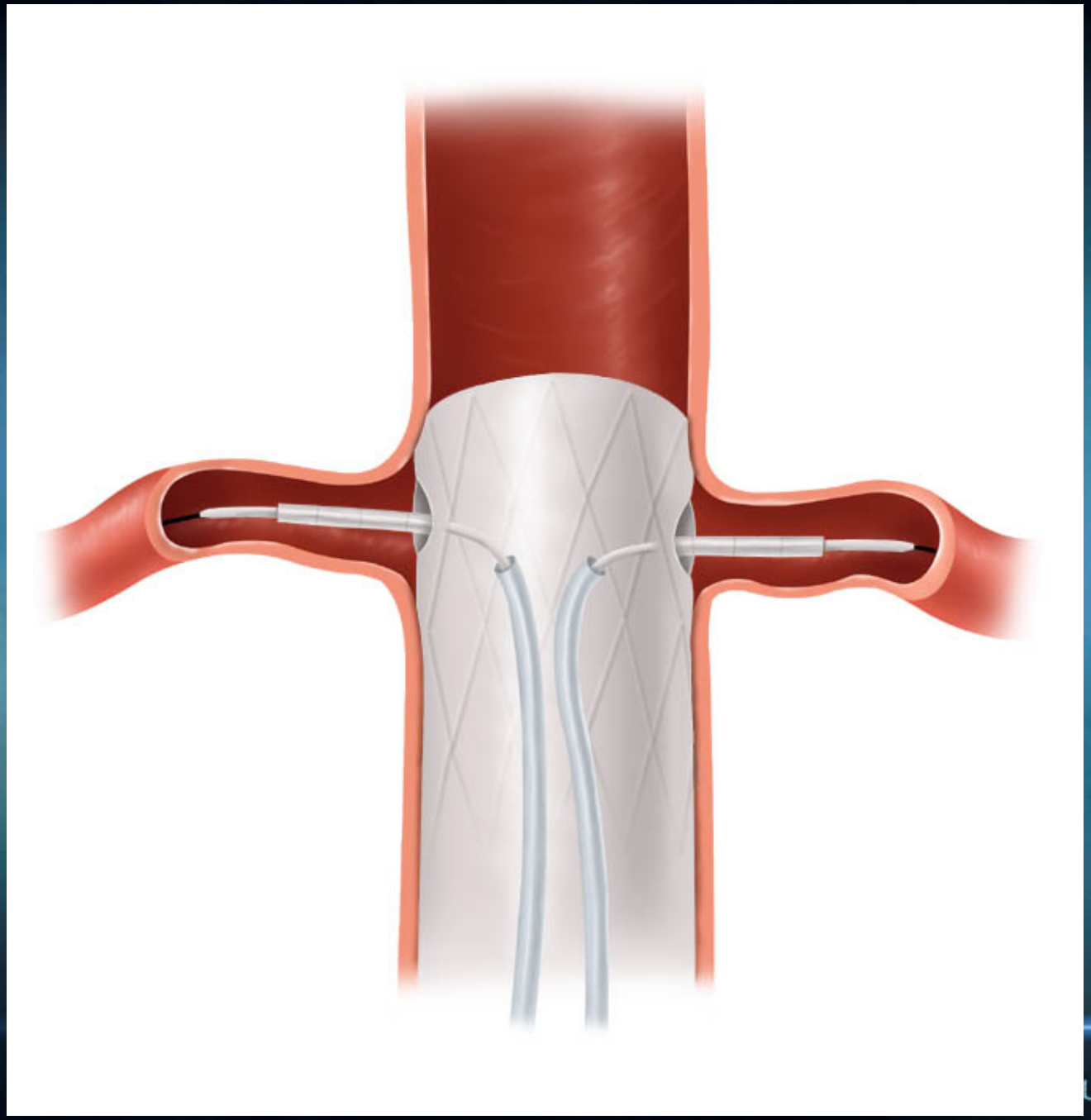
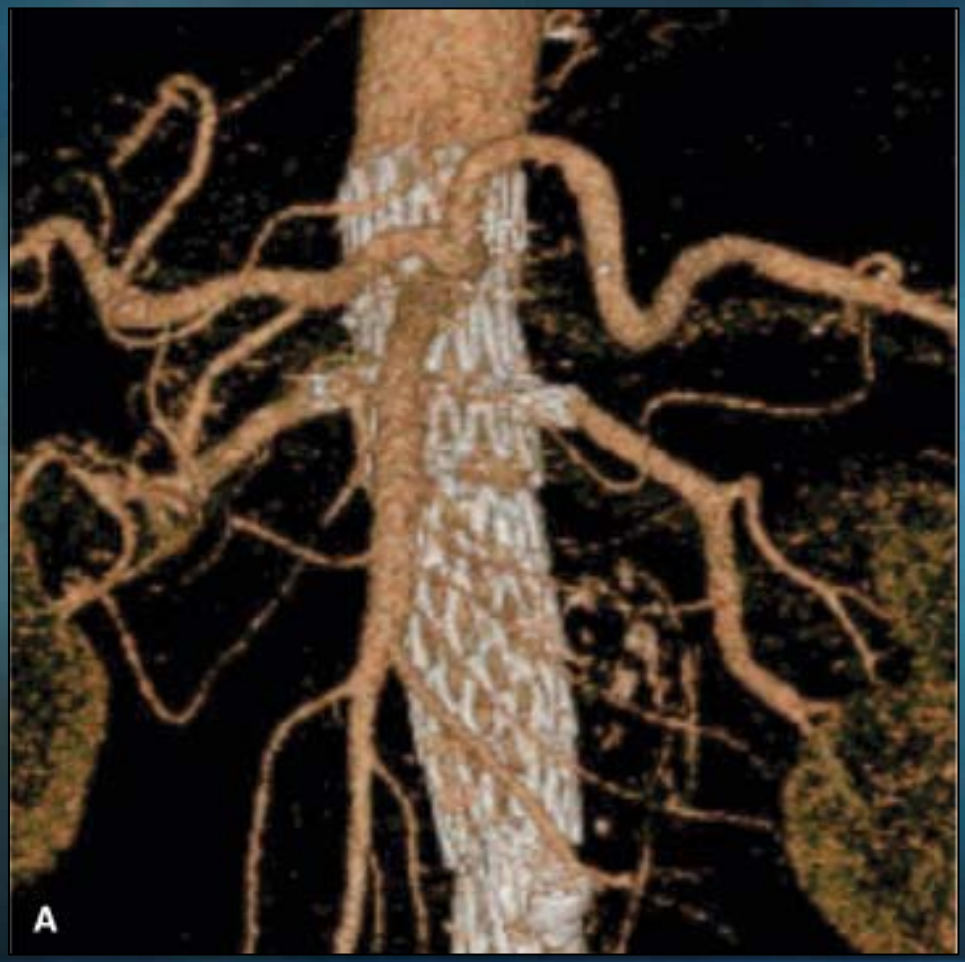
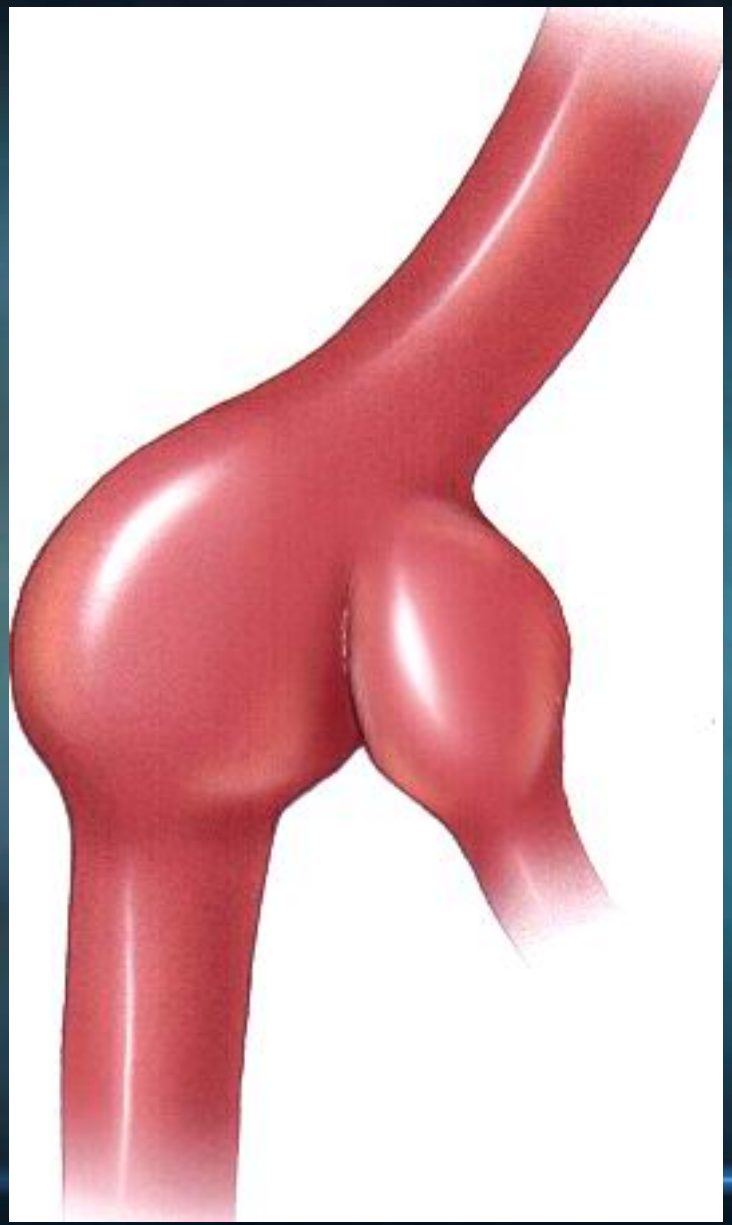






Three-dimensional reconstruction after fenestrated stent-graft with bare stents in the renal arteries. (Courtesy Dr. E. L. Verhoeven.) B, Artist's impression of branched endograft currently validated in experiment. (Courtesy Dr. W. Wisselink.)



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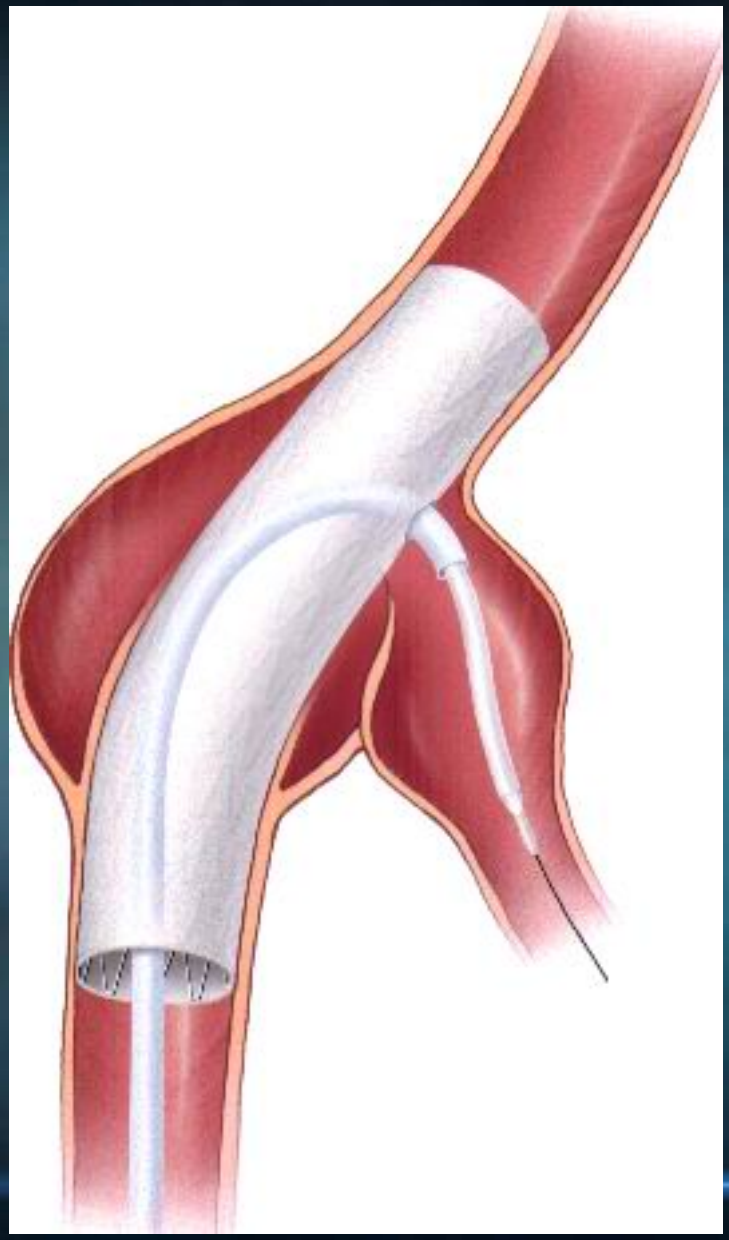

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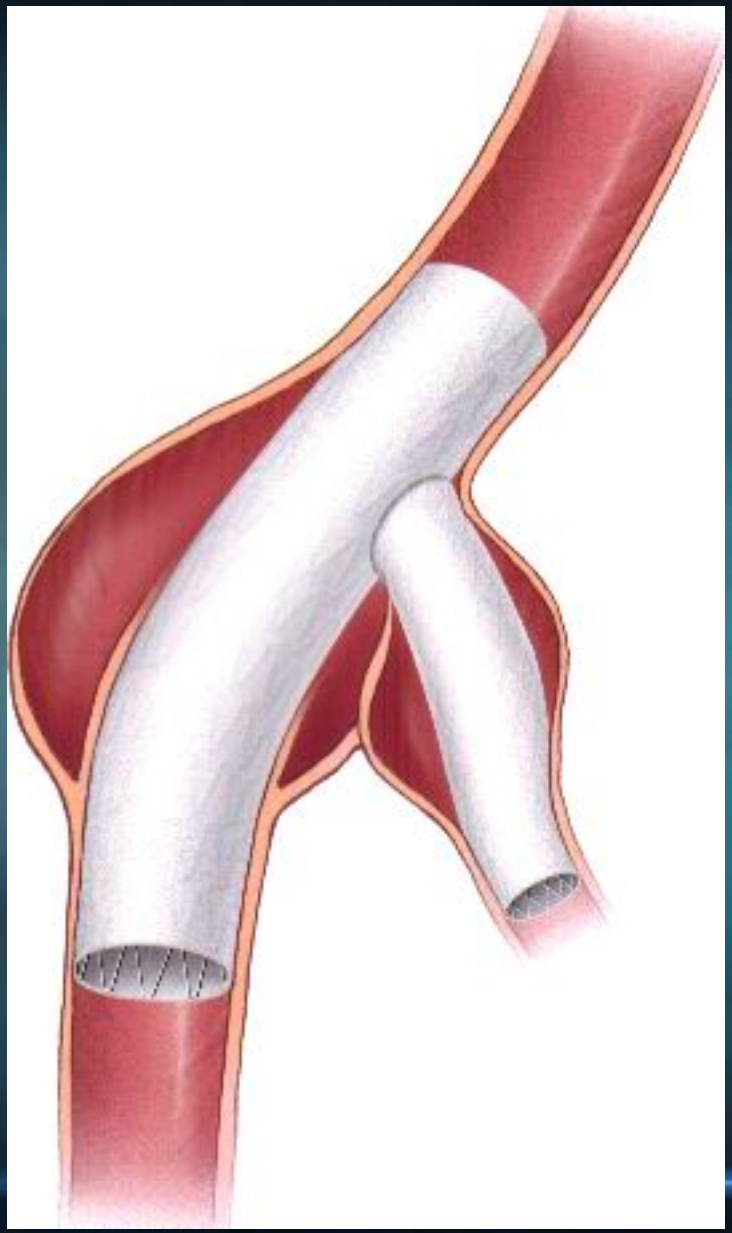

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- *1090 patients*
- *4.0 - 5.5 cm aneurysms*
- *Followed 4.6 years*

The UK Small Aneurysm Trial Participants

- *Mortality*
- *30 day 5.8% surgical group*
- *No difference at 2, 4, 6 years*

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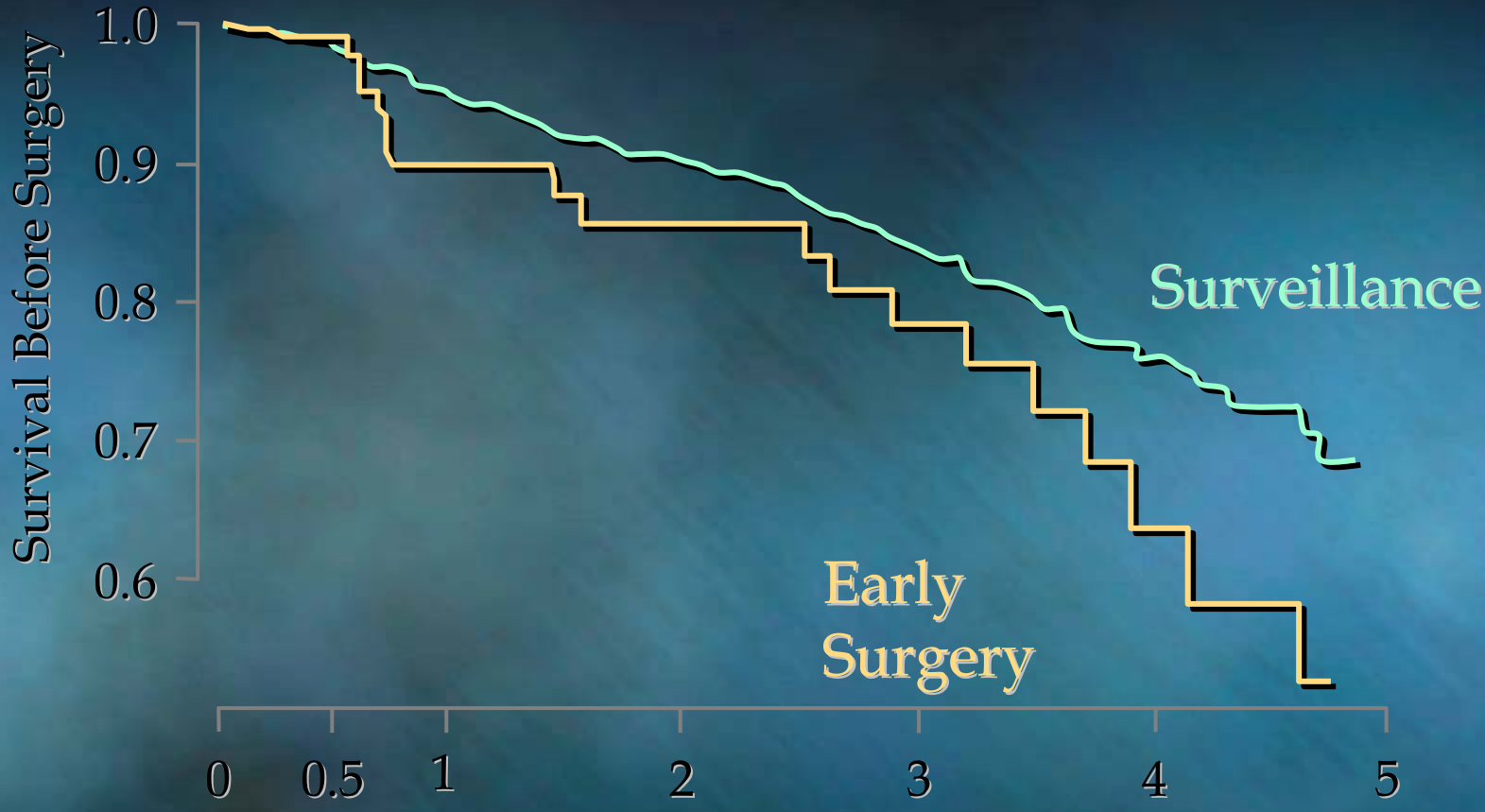
Survival by Randomized Treatment Group, up to Time of Surgery



Number at Risk

Surveillance	527	484	409	292	197	77	29
Early Surgery	563	91	54	38	32	14	9

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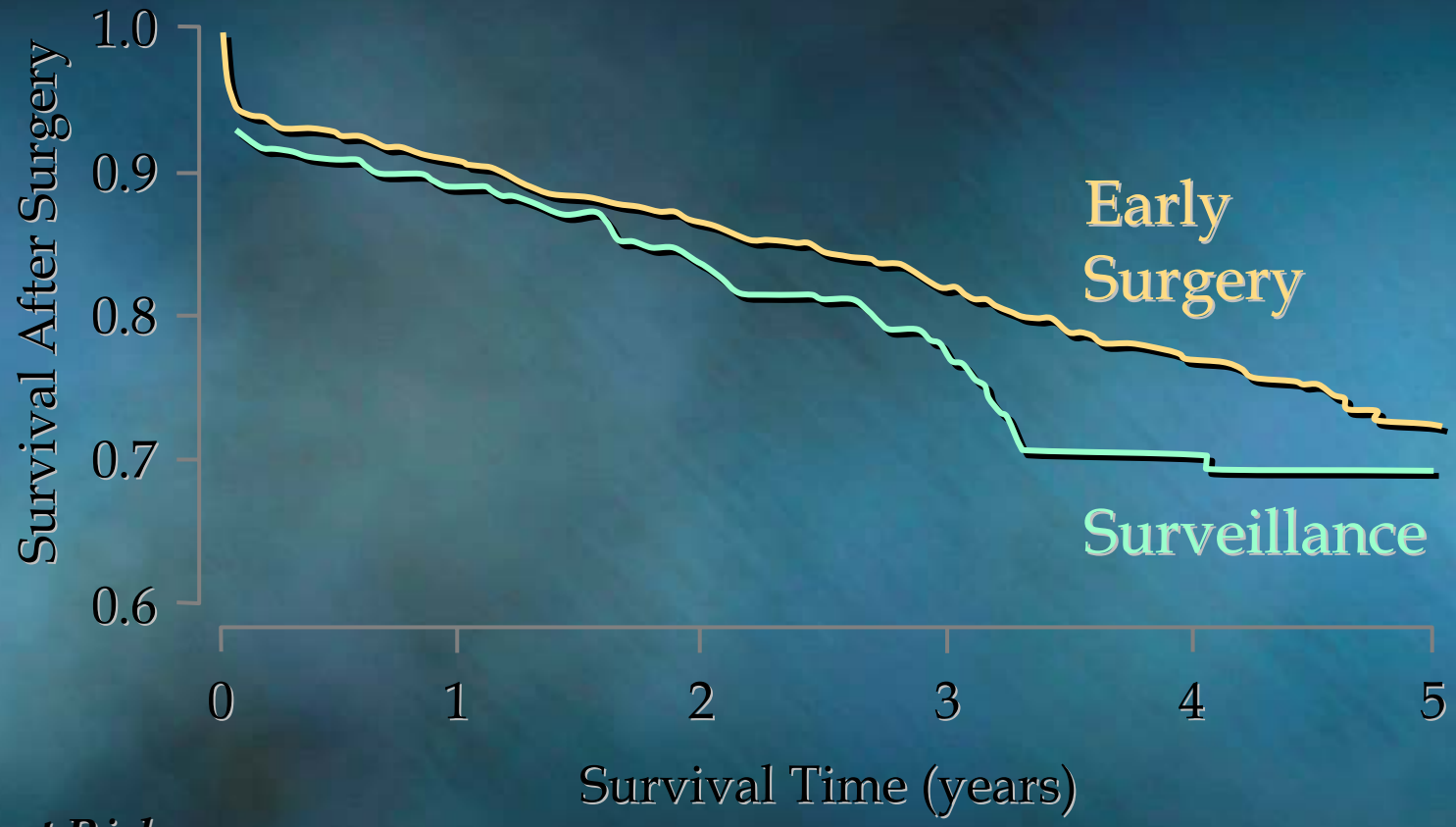
Survival by Randomized Treatment Group, After Time of Surgery



Number at Risk

Surveillance	321	241	182	117	60	28
Early Surgery	520	471	448	385	263	149

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	Deaths in Surveillance Group (n=150)	Deaths in early surgery group (n=159)
Cardiovascular Deaths		
Total	105	94
Myocardial Infarction	30	24
Stroke	7	5
Ruptured Thoracic Aneurysm	6	2
Ruptured AAA*	17	6
After AAA Repair†	18	26
Other Cardiovascular Deaths	27	31

***Ten (43%) of 23 ruptured AAA had diameter >5.5 cm †Underlying cause of death, within 14 days of operative repair ‡Patient died abroad, cause of death not known.**

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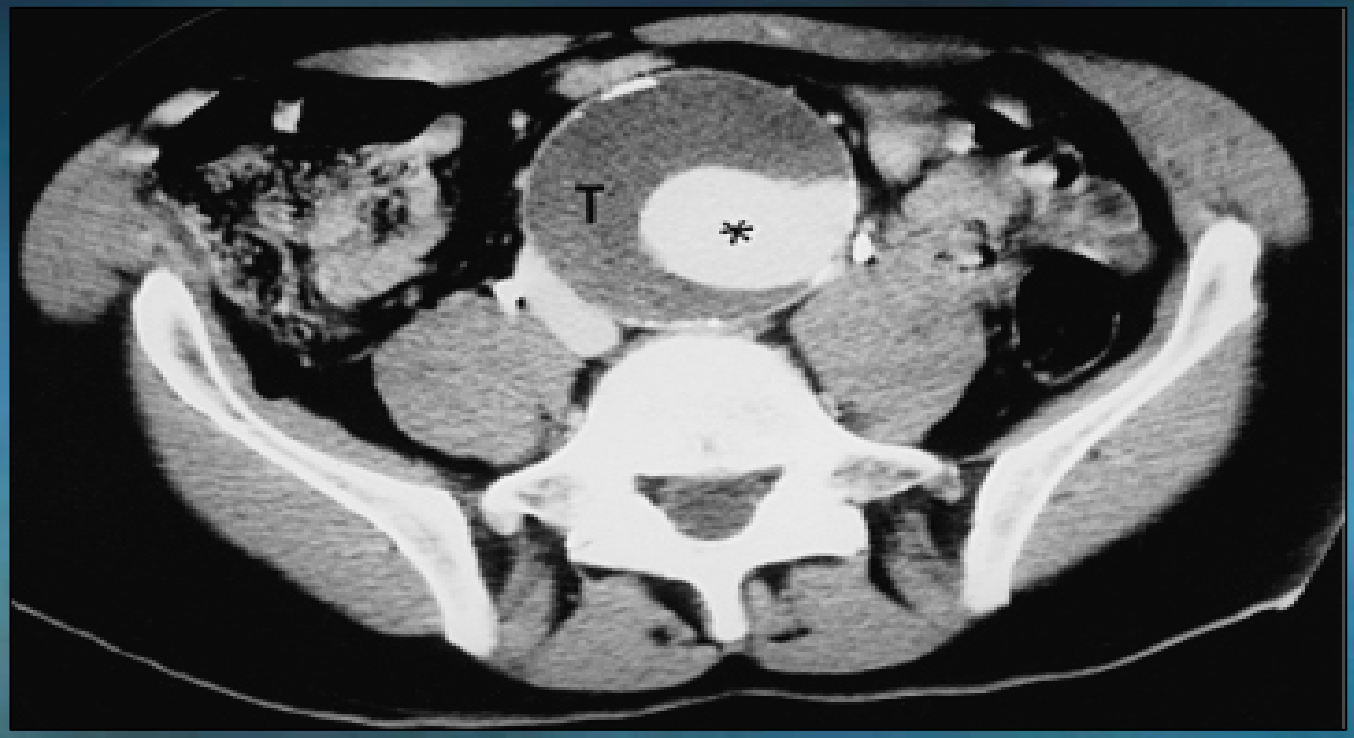

CT scan of abdominal aortic aneurysm shows contrast-filled lumen (*) surrounded by thrombus (T) within the aneurysm sac.

Angiotensin-converting enzyme inhibitors and aortic rupture: a population-based case-control study

Daniel G Hackam, Deva Thiruchelvam, Donald A Redelmeier

Summary

Background Angiotensin-converting enzyme (ACE) inhibitors prevent the expansion and rupture of aortic aneurysms in animals. We investigated the association between ACE inhibitors and rupture in patients with abdominal aortic aneurysms.

Methods We did a population-based case-control study of linked administrative databases in Ontario, Canada. The sample included consecutive patients older than 65 (n=15 326) admitted to hospital with a primary diagnosis of ruptured or intact abdominal aortic aneurysm between April 1, 1992, and April 1, 2002.

Findings Patients who received ACE inhibitors before admission were significantly less likely to present with ruptured aneurysm (odds ratio [OR] 0·82, 95% CI 0·74–0·90) than those who did not receive ACE inhibitors. Adjustment for demographic characteristics, risk factors for rupture, comorbidities, contraindications to ACE inhibitors, measures of health-care use, and aneurysm screening yielded similar results (0·83, 0·73–0·95). Consistent findings were noted in subgroups at high risk of rupture, including patients older than 75 years and those with a history of hypertension. Conversely, such protective associations were not observed for β blockers (1·02, 0·89–1·17), calcium channel blockers (1·01, 0·89–1·14), α blockers (1·15, 0·86–1·54), angiotensin receptor blockers (1·24, 0·71–2·18), or thiazide diuretics (0·91, 0·78–1·07).

Interpretation ACE inhibitors are associated with a reduced risk of ruptured abdominal aortic aneurysm, unlike other antihypertensive agents. Randomised trials of ACE inhibitors for prevention of aortic rupture might be warranted.

Lancet 2006;368:659-65

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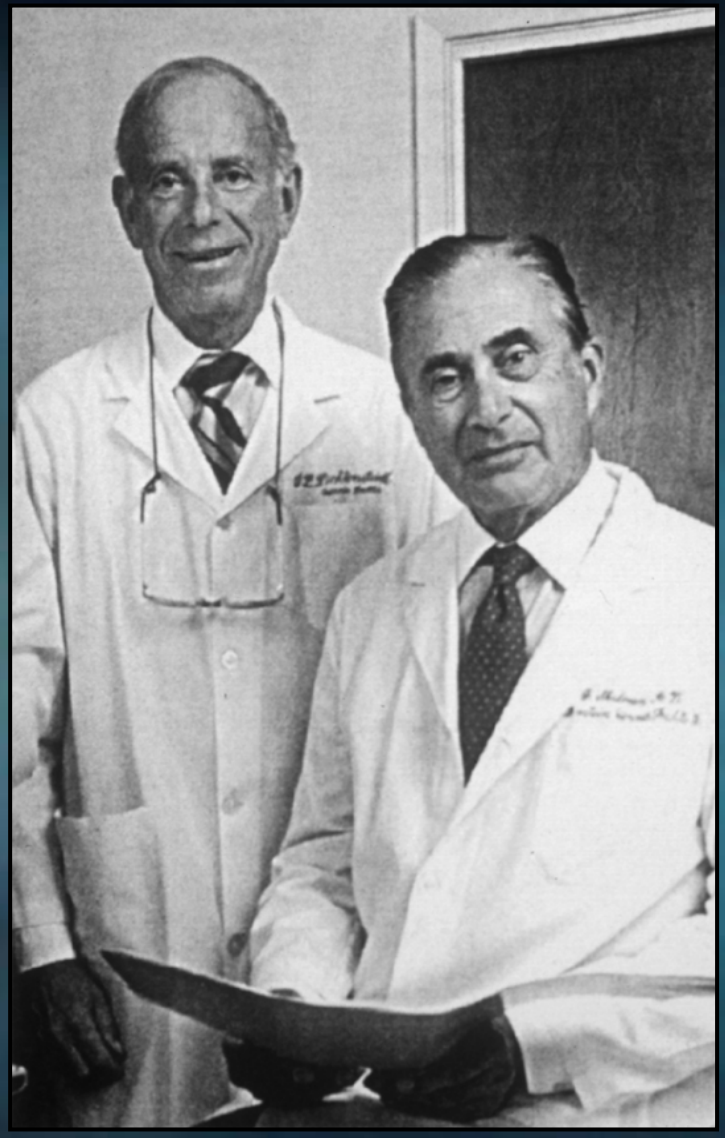
SPRING IN A PLASTIC SLEEVE DID THE TRICK

With the blood vessel now open, Dr. Dotter keeps an eye on the fluoroscope screen. When the patient began to feel pain in his lower leg and foot almost immediately the

Dr. Dotter's catheter, here held by his assistant, is a long stainless steel spring, encased in a plastic sleeve and containing wire to give it some rigid-



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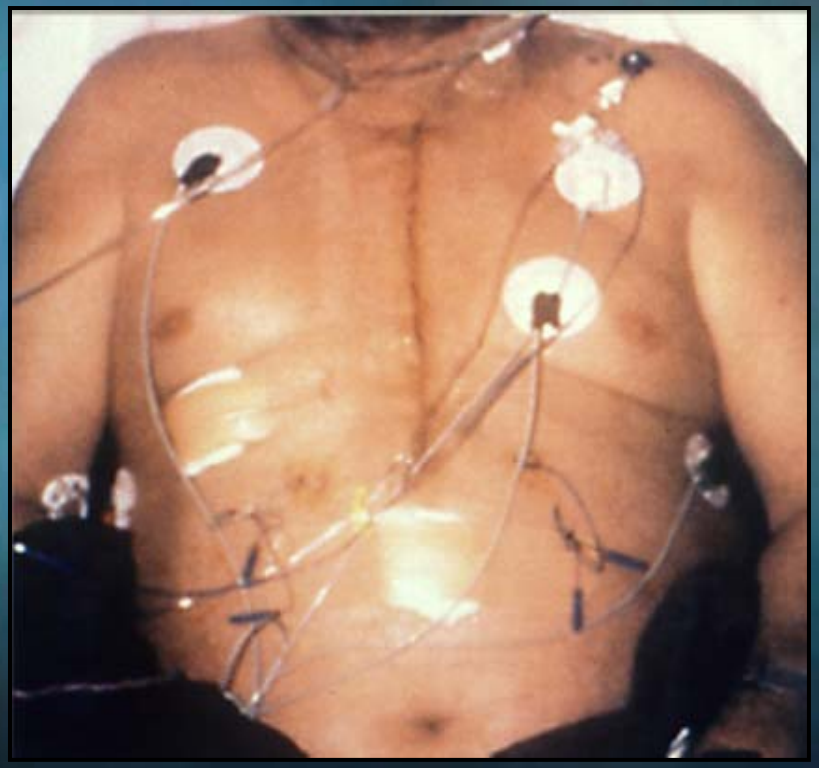
Minimally Invasive

CABG



MIDCAB™

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Wilshusen-3.AVI

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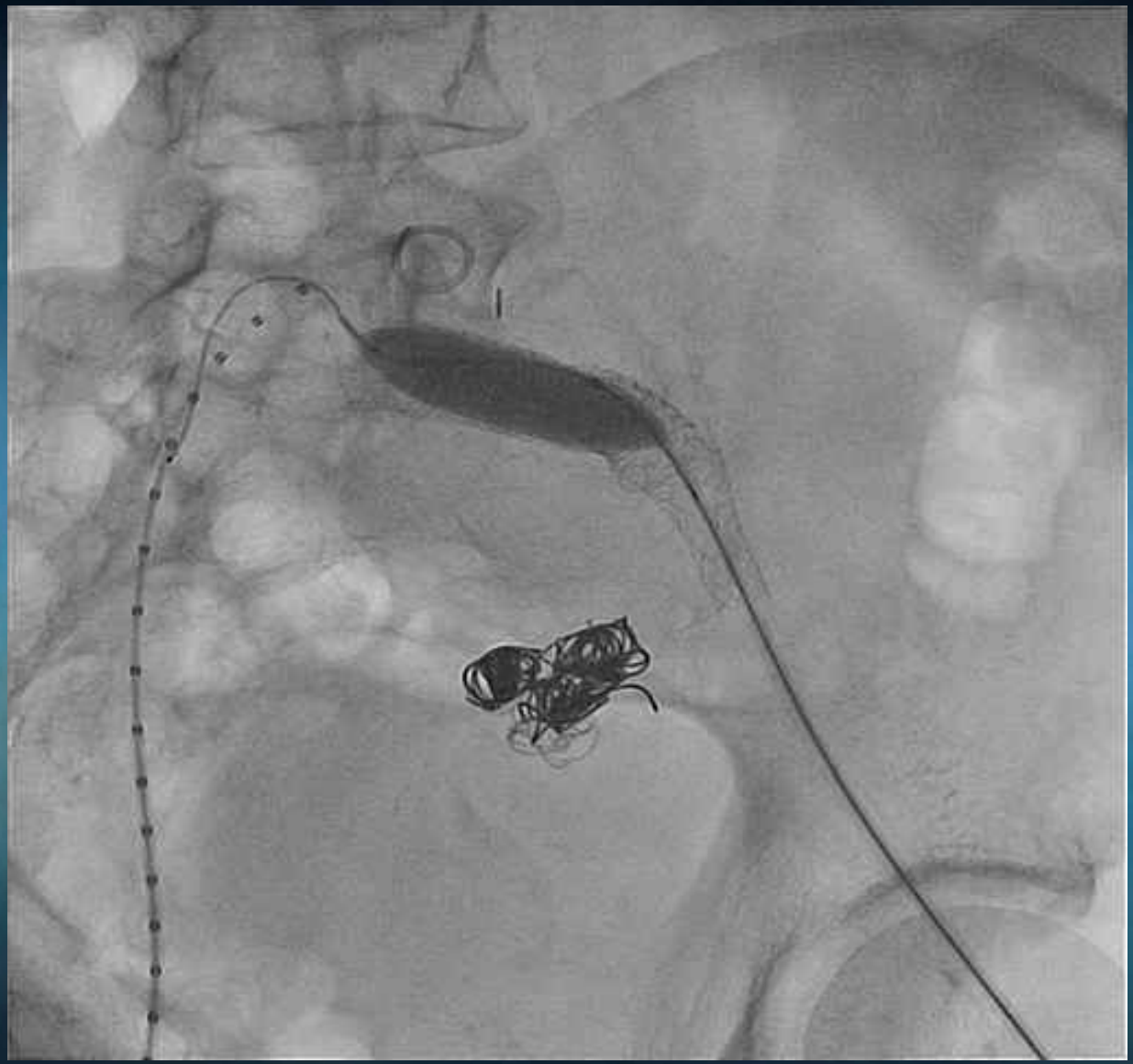

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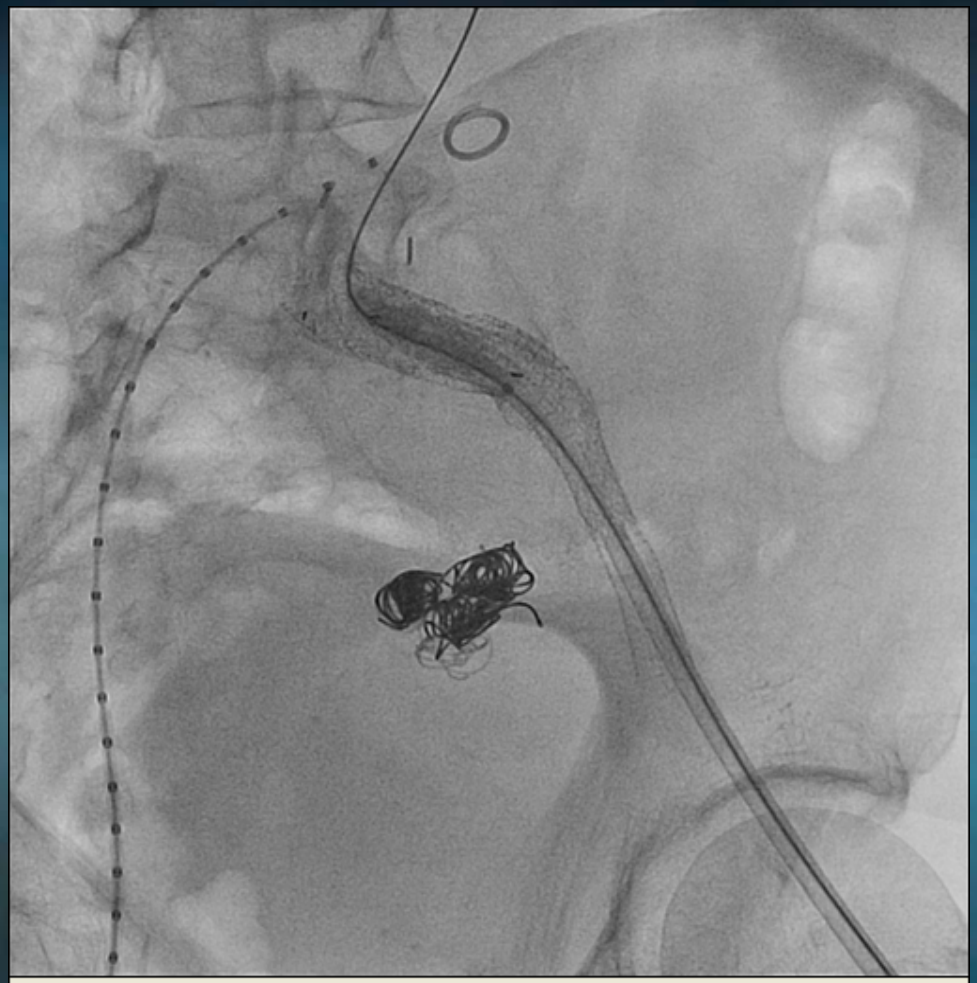
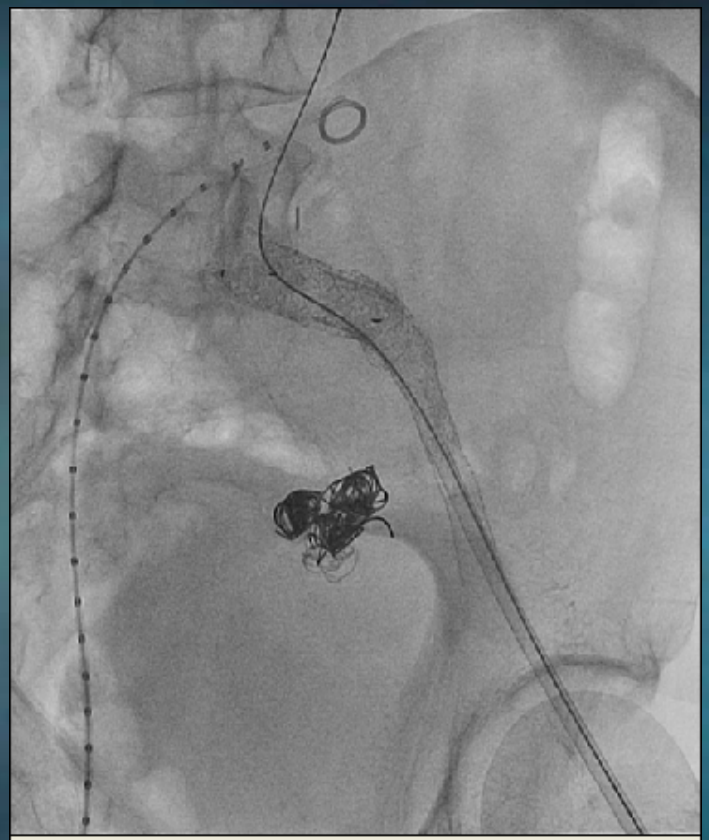


Wilshusen-4.AVI

R. Heuser



Wilshusen-5.AVI

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Abdominal Aortic Aneurysm

- *Proclivity for lower extremities aneurysms*
- *3.5% have other aneurysms (femoral/popliteal)*
- *Likewise if peripheral aneurysm look for abdominal aortic aneurysm*

Aneurysms

- *Can occur in any artery*
- *Most often in infrarenal abdominal aorta, accounting for 80% of all aneurysms*

Aortic Aneurysms

- *1 in10 men by 75 years of age will have an abdominal aortic aneurysm by ultrasound*
- *Women > 80 incidence approaches that in men*
- *Women with aneurysms are more likely to rupture and die then aneurysms in men*

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Let the battles begin

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Endoluminal Stent-Graft Demonstrated Advantages

- Minimally invasive surgery
- Reduced morbidity and ?mortality
- Less blood loss/need for transfusion
- Shorter hospital stay
- Quicker recovery time

Patient Preferred Treatment

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Conclusion

- *More patients will be recognized as having an abdominal aortic aneurysm in the future.*
- *More patients will be treated with less invasive procedures for abdominal aortic aneurysm in the future.*
- *Minimally invasive treatment of aneurismal disease will continue to be a fertile arena for research and development in the future.*

R. Heuser

"Interventional Repair of the Abdominal Aorta"

RICHARD R. HEUSER, MD, FACC, FACP,FESC
Medical Director, Phoenix Heart Center
Director of Cardiology, St. Luke's Medical Center
Clinical Professor of Medicine,
Univ. of Arizona, College of Medicine, Tucson, Arizona

R. Heuser

R. Heuser

What You Need to Know to do about Peripheral Intervention

- *Know the disease*
- *Know the anatomy*
- *Know the patients' symptoms*
- *Know and understand the non-invasive testing*
- *Know the alternatives*
- *Know the anticipated results*
- *Known the potential risks*

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Advantages of PTA Over Surgery

- *Excellent success rate*
- *Minimal morbidity and mortality*
- *Diminished length of hospitalization*
- *Minimal and absent recuperative period*
- *Decreased costs (early return to work)*
- *Small penalty for failure*

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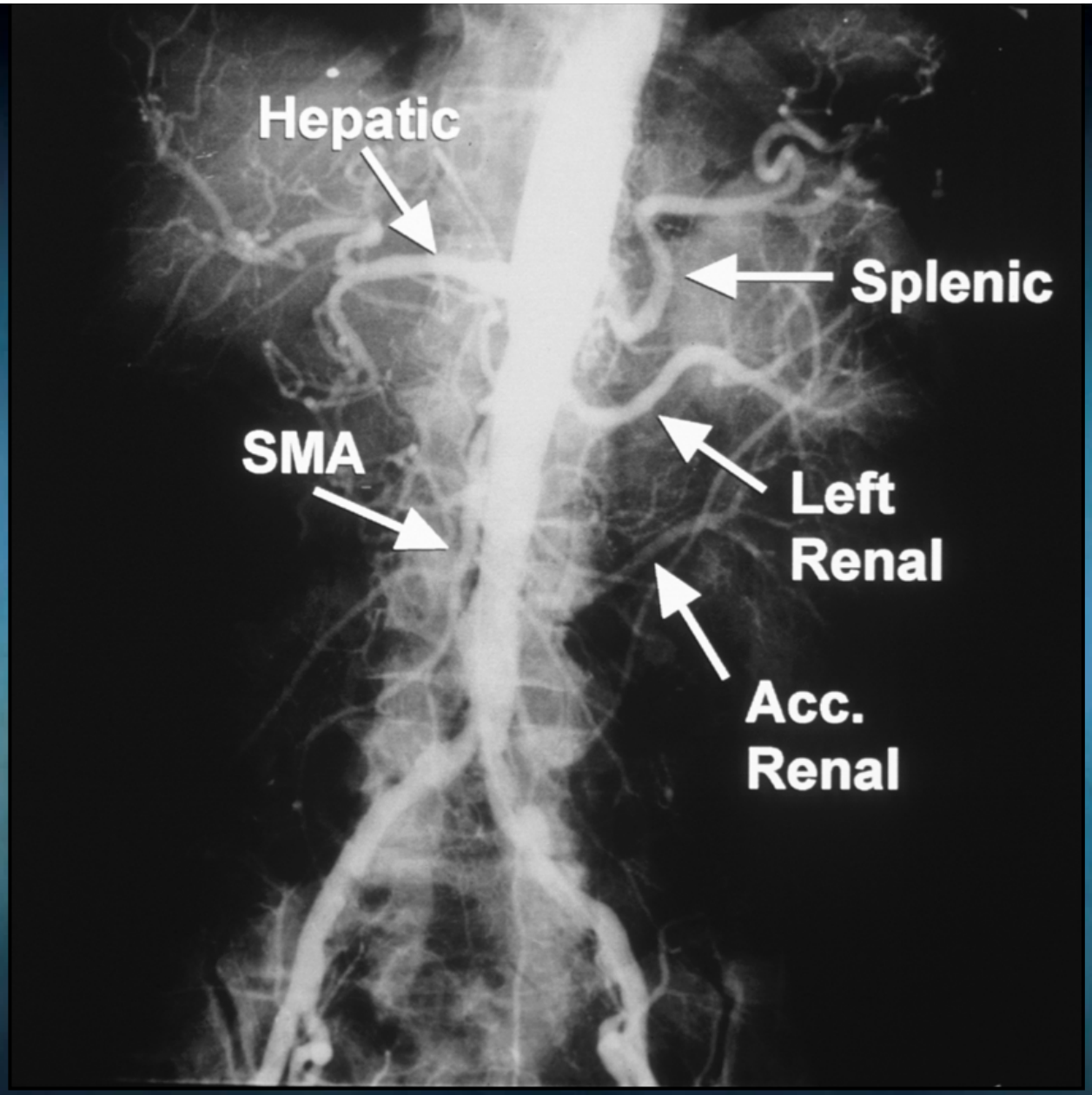

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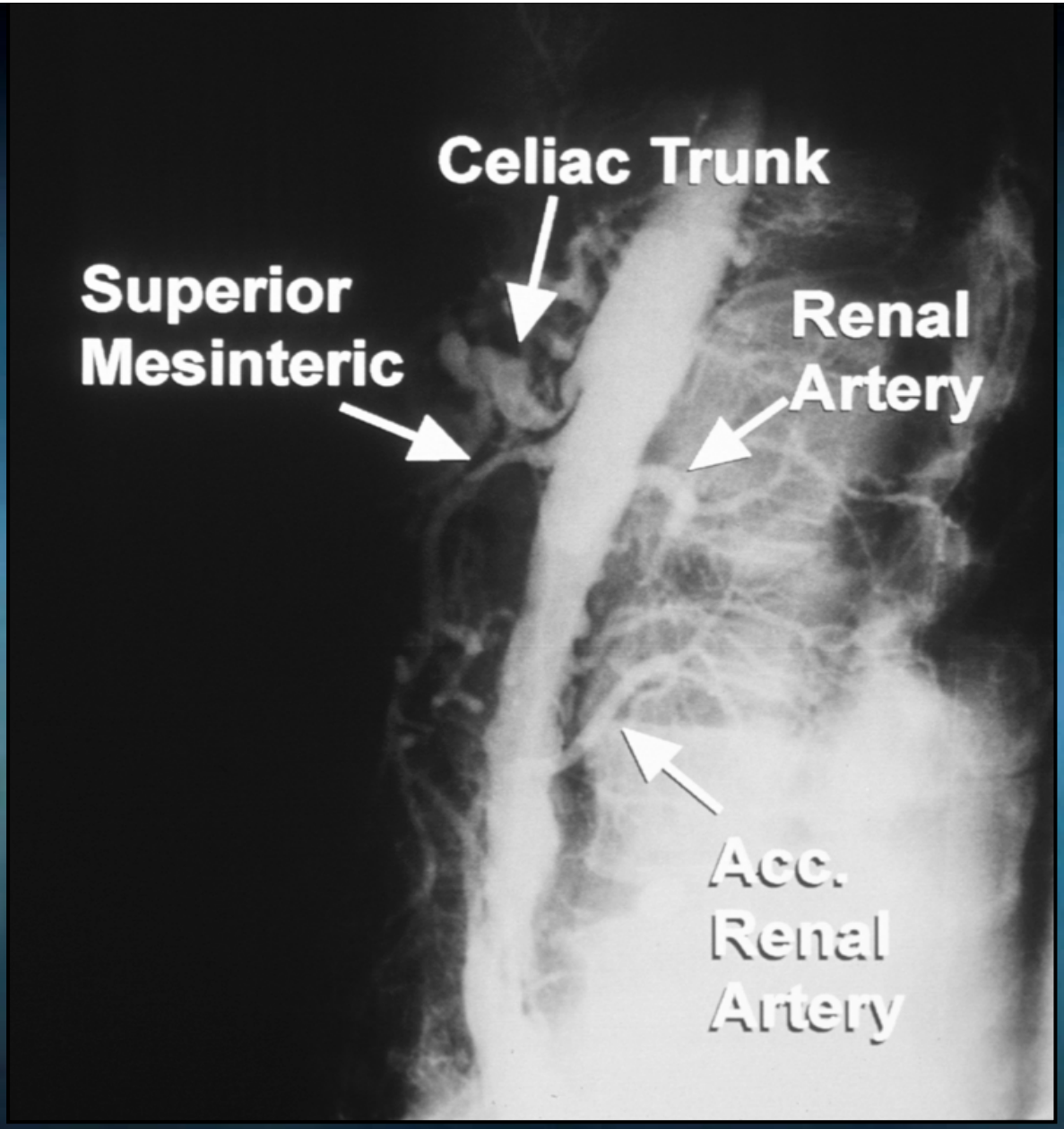
Celiac Trunk
Superior Mesinteric
Renal Artery
Acc. Renal Artery

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Aortic Aneurysms

- *Most are asymptomatic*
- *Best screen is abdominal ultrasound*
- *Natural history is to enlarge and rupture*
- *50% of untreated aneurysms will die of rupture*

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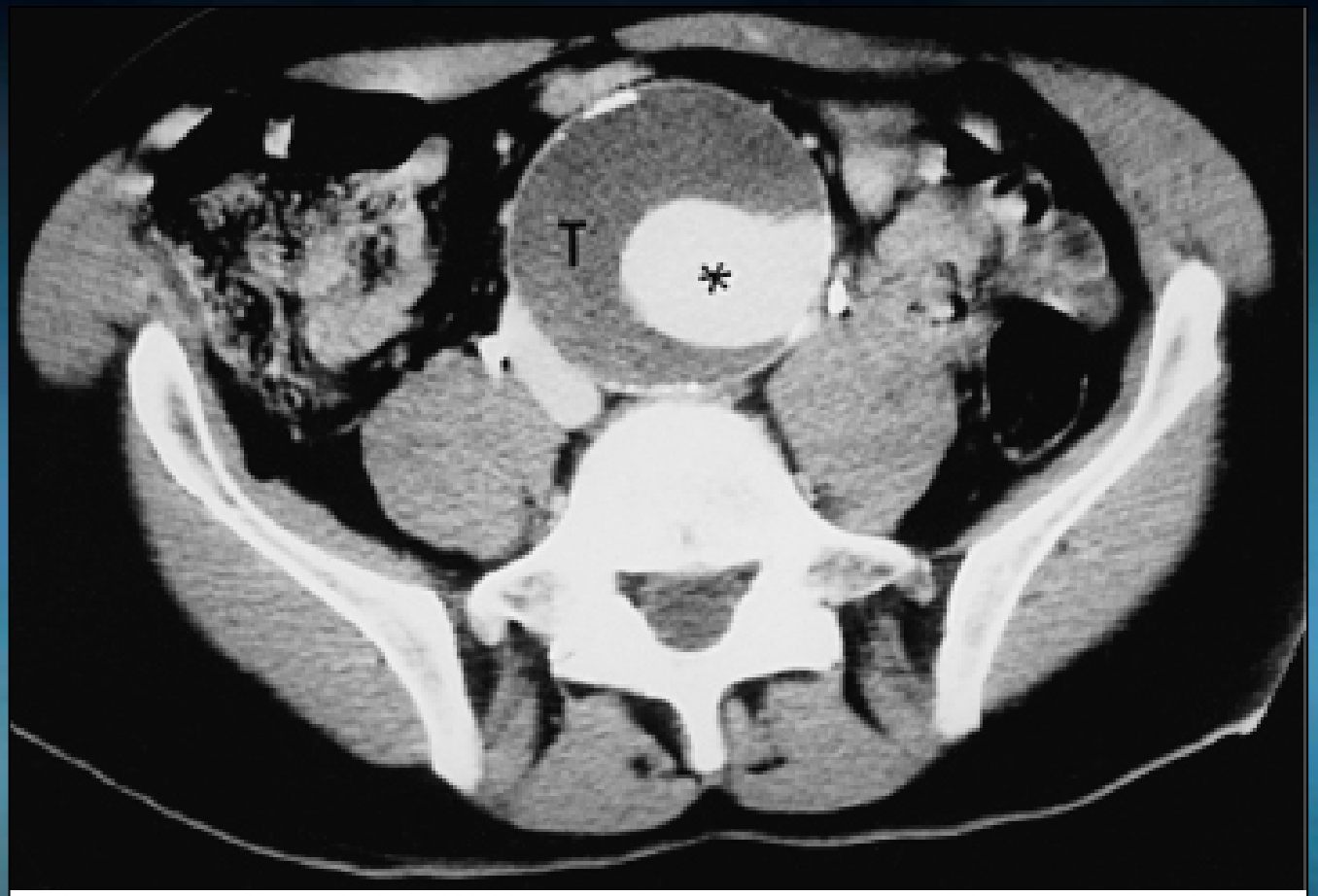

Figure 100-1 CT scan of abdominal aortic aneurysm shows contrast-filled lumen (*) surrounded by thrombus (T) within the aneurysm sac.

Abdominal Aortic Aneurysm Rupture

Annual Risk of Rupture

- *< 5 cm 1-2%*
- *5-6 cm 10%*
- *>6 cm 25%*

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