Update TAAA: Open Repair

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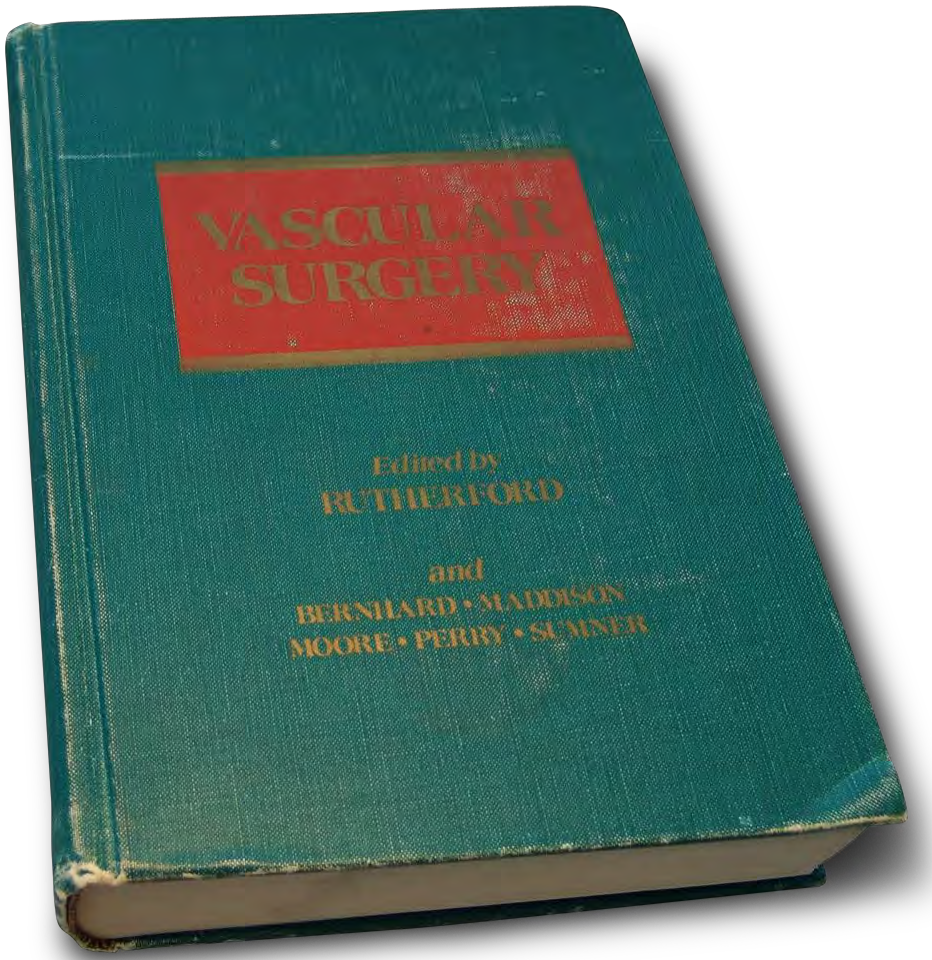
VASCULAR SURGERY
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aneurysm than when it bypasses occlusive disease, and is probably 5 per cent or less over a ten-year follow-up period. Conversely, anastomotic aneurysms are more common when aortoiliac bypass is done for aneurysmal disease than when it is done for occlusive disease. The total late failure rate, including late graft occlusion, recurrent (anastomotic) aneurysm, and aortoenteric fistula, probably is well under 10 per cent now that porous, compliant, knitted Dacron prostheses and stronger synthetic suture materials are being used routinely by most vascular surgeons. The management of the latter two complications is dealt with in Chapters 79 and 80, respectively.

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THE MANAGEMENT OF THORACOABDOMINAL AORTIC ANEURYSMS

H. Edward Garrett, M.D.

Aneurysmal involvement of the upper abdominal aorta and its major visceral branches may represent simply a more proximal than usual extension of a primarily infrarenal process. Alternatively, in approximately 50 per cent of cases, it also may involve the lower descending thoracic aorta and constitute a true thoracoabdominal aortic aneurysm. As a group, these aneurysms present a very serious challenge to the surgeon in terms of successful operative management, but they may be resected successfully with graft replacement in most instances.

The major problems encountered in operative management of thoracoabdominal aneurysms relate to the magnitude of the operative procedure, usually requiring entry into both abdomen and thorax; massive blood transfusions; temporary interruption of arterial blood supply to vital organs supplied by the celiac, superior mesenteric, and renal arteries; and the risk of ischemia of the spinal cord, which may result from interruption of upper lumbar or lower intercostal arteries.

Aneurysms arising in the upper abdominal aorta and lower descending thoracic aorta may be classified according to etiology, extent of the lesion, or underlying pathologic process. They may be atherosclerotic, dissecting, syphilitic, traumatic, or mycotic, or may result from weakness or absence of elastic tissue in the aortic wall on a congenital or inflammatory basis. They may be fusiform and extensive, or sacciform and localized. However, at least 75 per cent of those encountered in Western populations appear to be atherosclerotic in origin and fusiform in type.

Aneurysms of the upper abdominal aorta are subject to all the complications described for infrarenal aortic aneurysms, namely, expansion and rupture, compression or erosion of adjacent organs, spine, or body wall with symptoms produced according to location and extent of the lesion. The likelihood of serious symptomatic presentation increases with size, and associated hypertension increases the risk of rapid progression of the lesion. Peripheral emboli and stenosis or thrombosis of visceral artery branches also may occur. The relative incidence of the above problems is not well established owing to the lack of large reported series of these rare aneurysms.

DIAGNOSIS

Any pulsatile mass palpable in the epigastrium or upper abdomen may represent an aneurysm of the upper abdominal aorta. Plain x-rays frequently reveal calcification in the wall of the aneurysm, and may provide some indication of the location of the lesion. Sonography also may be helpful (see Chapter 76), but arteriography, including *oblique* and *lateral* views, usually is necessary to

Courtesy of Chris Akers

SUCCESSFUL RESECTION OF A LARGE ANEURYSM OF THE UPPER ABDOMINAL AORTA AND REPLACEMENT WITH HOMOGRAFT

SAMUEL N. ETHEREDGE, M.D.,* JAMES YEE, M.D.,** JOHN V. SMITH, M.D.,**
STANLEY SCHONBERGER, M.D.,** AND MERVIN J. GOLDMAN, M.D.,***
OAKLAND, CALIF.

(From the Veterans Administration Hospital)

IN THE past few years great strides have been made in the field of vascular surgery with the introduction of arterial homografts and various plastic prostheses as replacement for resected segments of diseased major vessels. Hufnagel,[1] Gross,[2, 3] Bahnson,[4] Deterling,[5, 6] Brown, Swan,[7] DeBakey and Cooley,[8, 9] and many others[11-14] have reported very encouraging results, particularly in the treatment of aneurysms. The practice of resection and replacement by graft would now seem so well
choice that the previous types of therapy, suc
or endoaneurysmorrhaphy, will either be ra
the particular cases where such a major proc
one reason or another.

Schafer and Hardin,[10] writing on the use o
during the resection of an aneurysm, stated t
cause of damage to the diseased aorta abov
been successful our resection and graft repla
entire abdominal aorta with its celiac, superio
—a *feasible procedure*." It was this statement
to operate upon the patient we are reporting.
literature, we believe this to be the first such c

CASE REPORT

A 37-year-old Negro male construction worker
ministration Hospital, Oakland, California, on July 7,
of right chest pain of four days' duration. On July
patient had experienced a sharp, breath-taking pain in
side of the chest, resulting in loss of consciousness o
At an emergency hospital the patient was told that
treated accordingly. There were no respiratory sympt
breathing. The chest pain subsided after two hours' t
dressing, severe right lower chest pain recurred and t
pain persisted for six hours. On July 6, the patient wa
to work. While at work on the morning of July 7, t

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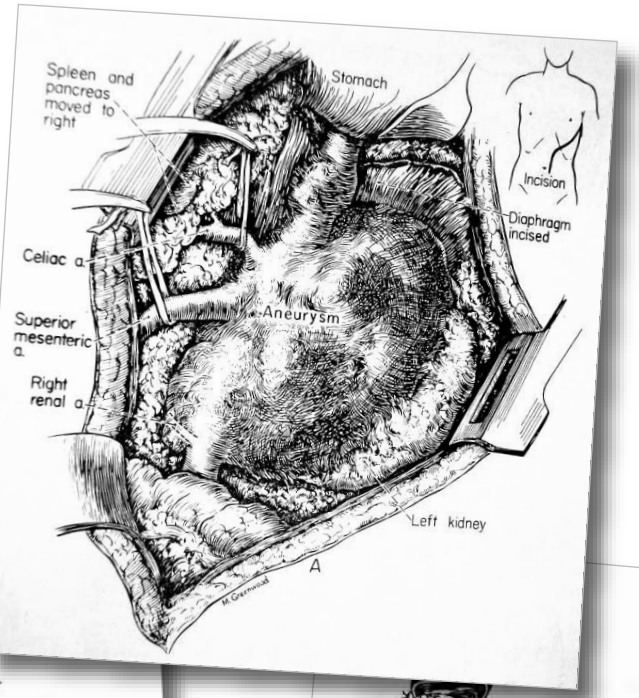
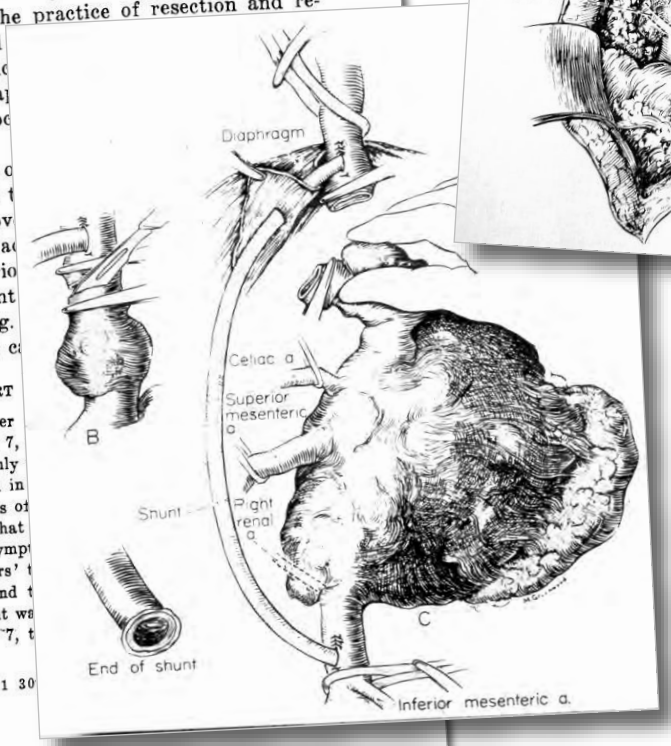
*Consultant, Peripheral Vascular Diseases, 411 30
**From the Surgical Service.
***From the Medical Service.





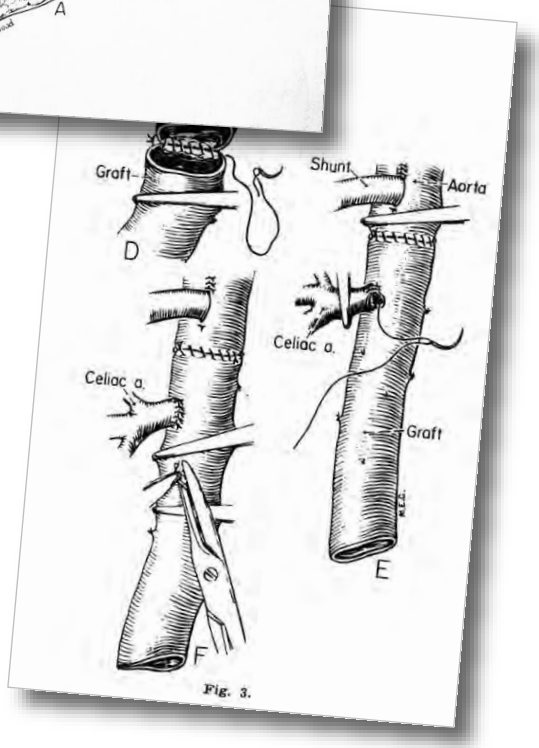


Fig. 3.


FACULTY

Aneurysm of Thoracoabdominal Aorta Involving the Celiac, Superior Mesenteric, and Renal Arteries. Report of Four Cases Treated by Resection and Homograft Replacement *

MICHAEL E. DEBAKEY, M.D., OSCAR CREECH, JR., M.D., GEORGE C. MORRIS, JR., M.D.**

Houston, Texas

MOST aneurysms of the abdominal aorta fortunately arise below the origin of the renal arteries, so that resection is not associated with serious ischemic damage to vital structures.[10] In the small proportion of cases, however, in which the aneurysm is located in the upper segment of the abdominal aorta including its major visceral branches, this problem assumes grave significance. In such cases there is considerable danger of producing fatal ischemic damage to such vital structures as the liver, kidneys, and gastro-intestinal tract, as a consequence of temporary arrest of blood flow to these organs during the period required to excise the aneurysm and replace it with an aortic homograft.

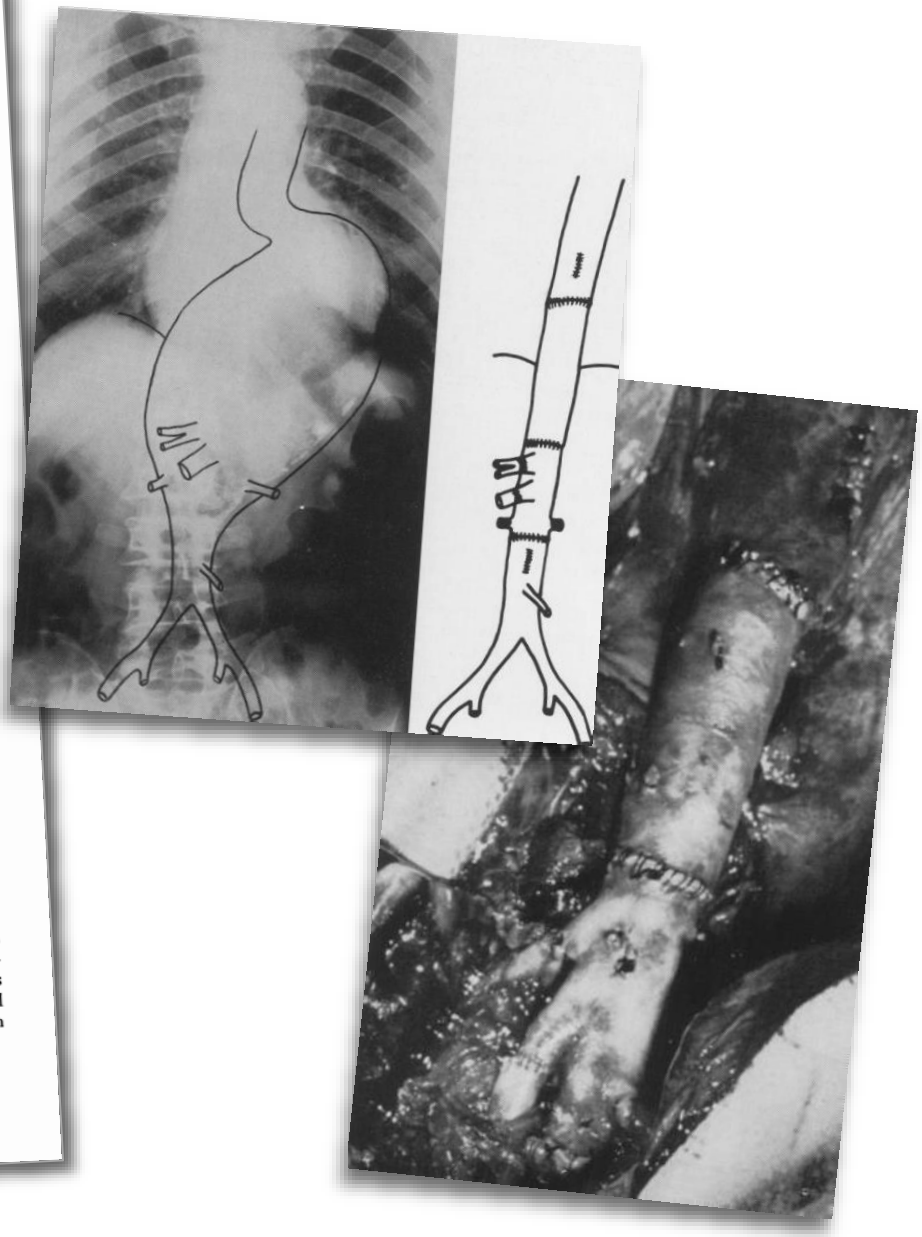
This report is concerned with our experiences with resection of aneurysms of this latter type and replacement by homografts in four cases. The aneurysms in all of these cases extended from the lower descending thoracic aorta to the lower abdominal aorta and involved the celiac, superior mesenteric, and one or both renal arteries. So far as we have been able to determine from a review of the literature, there have been no records of similar cases in which all these vessels were involved, although two cases with involvement of some of these vessels were recently reported. In one of these the aneurysm arose below the origin of the normally placed left renal artery but involved the renal artery of an ectopic right kidney, and it was successfully resected and arterial continuity to the right kidney restored after replacement with a homograft.[21] In the other case the aneurysm, involving the celiac, superior mesenteric, and left renal arteries, was successfully resected and the segment replaced with a homograft so that continuity to the celiac and superior mesenteric arteries was restored but the left kidney was excised.[22]

In the four cases to be reported the operative procedure consisted in excision of the aneurysm and replacement with an aortic homograft with restoration of continuity to the celiac axis and superior mesenteric arteries in all, as well as to both renal arteries in two and to one of the renal arteries in the other two cases. Because of the extensive nature of this operative procedure and the problems it poses in terms of technical management as well as functional disturbances of vital organs, it seems desirable to record these cases and to consider certain observations derived from this experience, relating particularly to surgical management and to significant studies on renal and hepatic function.

* Presented before the American Surgical Association, White Sulphur Springs, West Virginia, April 11–13, 1956.

Supported in part by the Houston Heart Association.

** From the Cora and Webb Mading Department of Surgery, Baylor University College of Medicine, and the surgical services of the Veterans Administration, Methodist, and Jefferson Davis Hospitals, Houston, Texas.



ANEURYSMS OF THE THORACIC AORTA

Analysis of 179 Patients Treated by Resection

Michael E. DeBakey, M.D., Denton A. Cooley, M.D., E. Stanley Crawford, M.D. (by invitation), and George C. Morris, Jr., M.D. (by invitation), Houston, Texas

DURING the 7-year period since our first successful resecti
of the thoracic aorta, this method of therapy has bee
cases. This report is concerned with certain observation
analysis of this experience, particularly in relation to m
and to factors bearing upon risk of operation. Although t
ciple of therapy consisting essentially in excision of the
for all cases, the method of its application varies in accor
and location of the lesion. Accordingly, the cases are clas
gories, namely, aneurysms of the descending thoracic aor
aortic arch, thoracoabdominal aneurysms, and dissecting

ANEURYSMS OF THE DESCENDING THORACIC AORTA

This group, comprising 73 cases, represents the larg
reflects the relative frequency of involvement of this
aorta. The great majority of these aneurysms were f
varying in size from relatively small, well-localized lesic
aneurysms that involved virtually the entire descending
1 and 2). Their site of involvement was also variable, al
90 per cent were located in the proximal portion of th
aorta. Contrary to earlier reports that syphilis is the m
factor for aneurysms of the thoracic aorta, in this ser
the most common cause and syphilis was second in fr
incidences being 47 per cent and 32 per cent (Table I).

The age of these patients ranged from 10 month
of them, 83 per cent, were in the fifth to seventh deca
predominant in a ratio of about 3 to 1.

From the Cora and Webb Mading Department of Surgery, Baylor University College of Medicine, and the surgical services of the Jefferson Davis, Methodist, and Veterans Administration Hospitals, Houston, Texas.

Supported in part by the U. S. Public Health Service under Grant H-3137 and by the Houston Heart Association.

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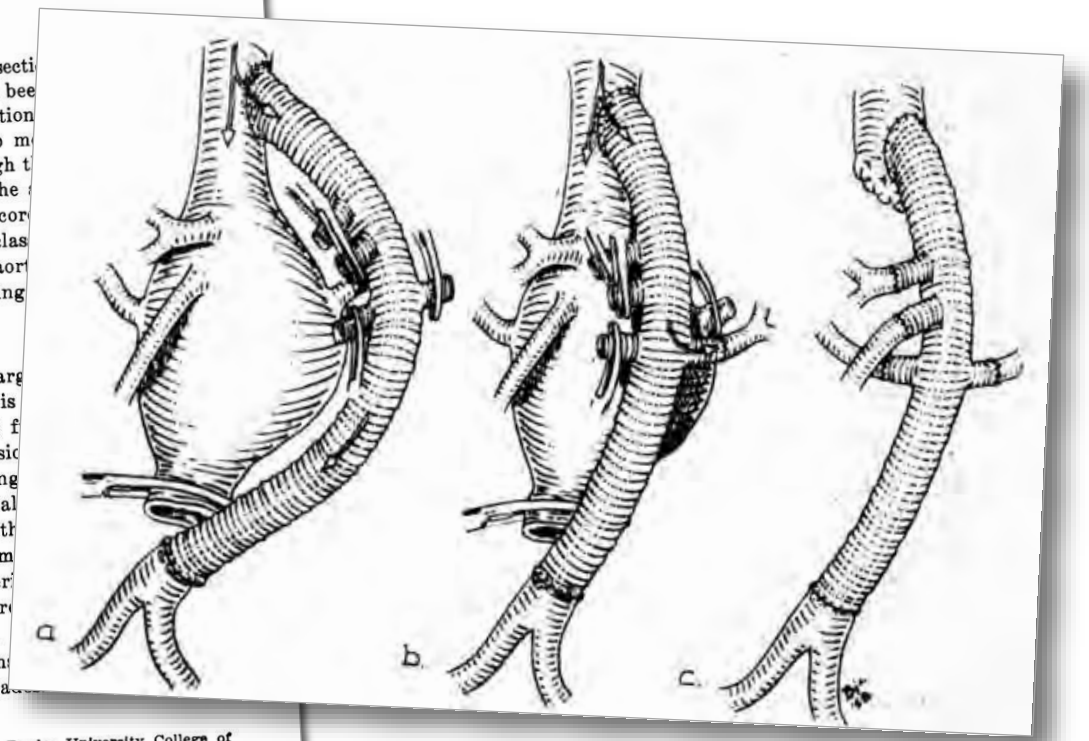
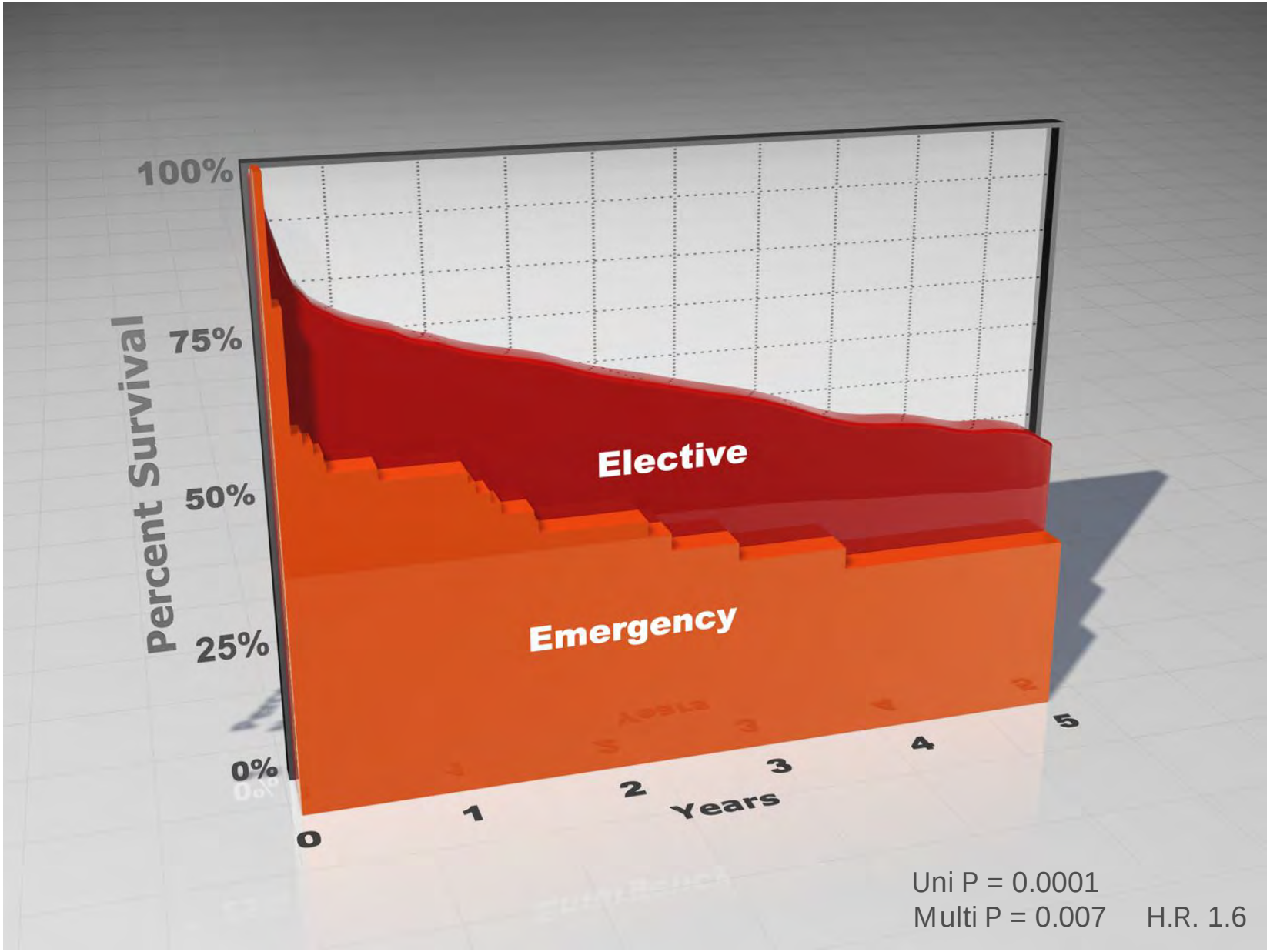



100%
75%
50%
25%
0%
Percent Survival
Elective
Emergency
0
1
2
3
4
5
Years
Uni P = 0.0001
Multi P = 0.007
H.R. 1.6

Progress in Treatment of Thoracoabdominal and Abdominal Aortic Aneurysms Involving Celiac, Superior Mesenteric, and Renal Arteries

E. STANLEY CRAWFORD, M.D., DONALD M. SNYDER, M.D., GWEN C. CHO, M.D., AND JOHN O. F. ROEHM, JR., M.D.

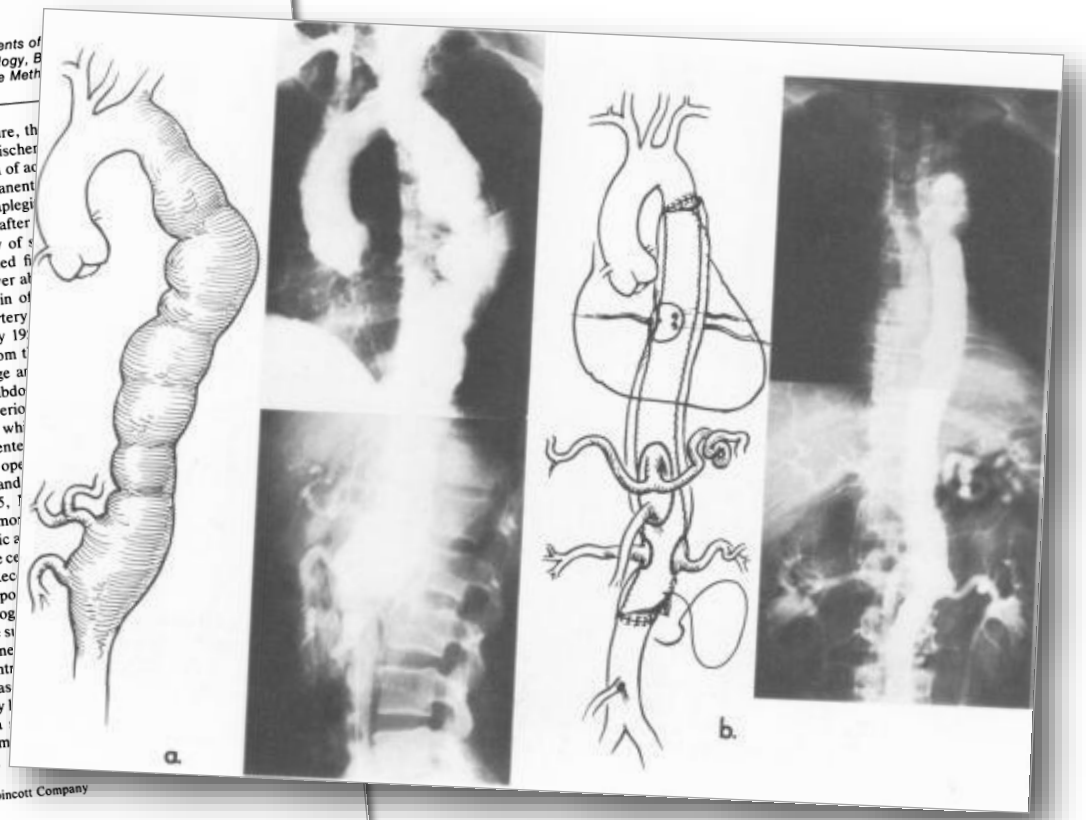
From the Departments of Radiology, B The Meth

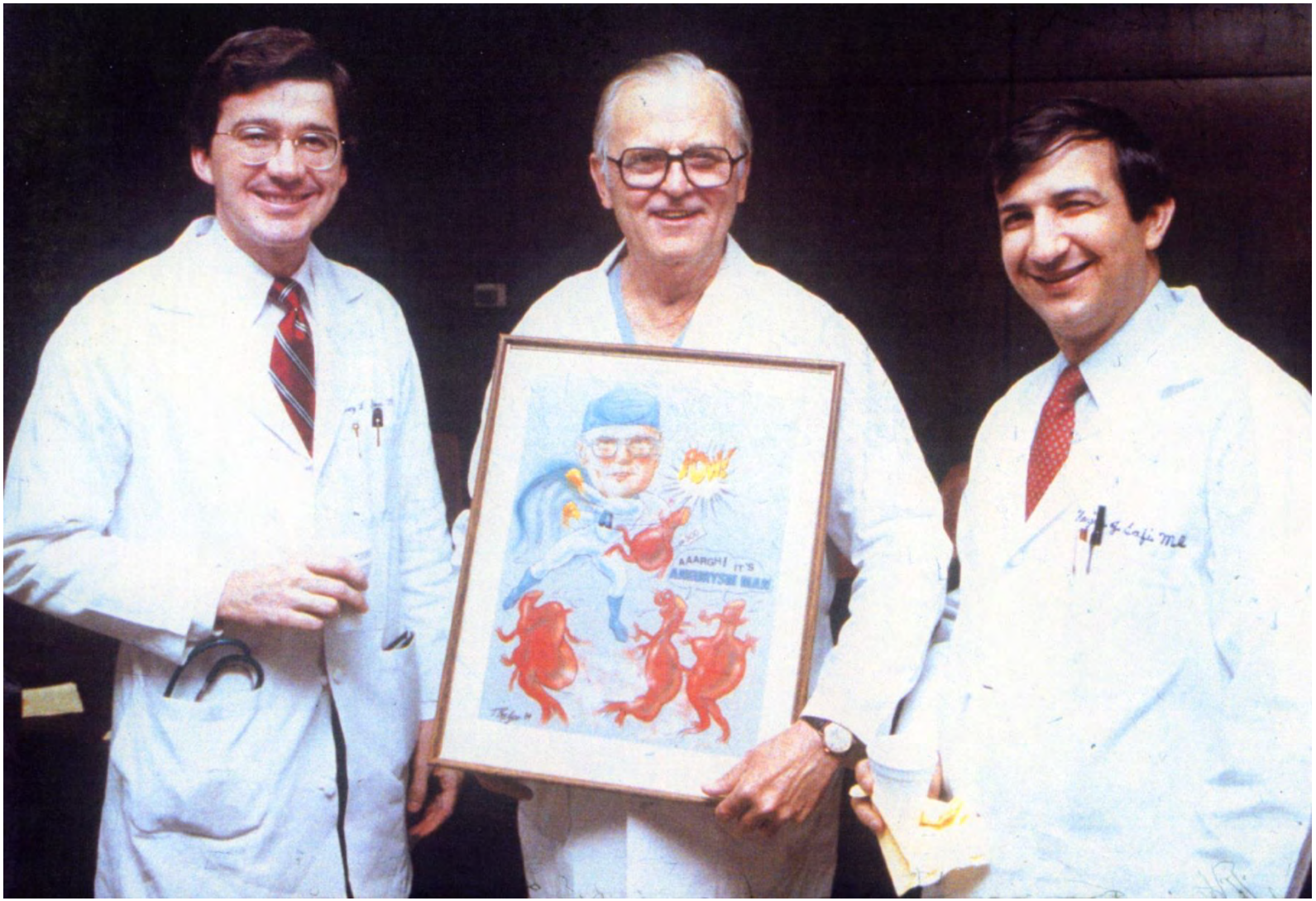
This is a report of surgical treatment of thoracoabdominal aortic aneurysms and aneurysms of the abdominal aorta from which the visceral vessels arise during the 18 year period from April 5, 1960, to April 20, 1978. The extent of aneurysm is divided into five groups. Group I (10 patients) involved most of the thoracic and abdominal aorta down to celiac axis. Group II (22 patients) involved most of the thoracic and abdominal aorta distal to left subclavian artery. Group III (20 patients) were those with lesser involvement of the thoracic aorta and most of the abdominal aorta. Group IV (18 patients) with involvement of the entire abdominal aorta and Group V (12 patients) with involvement of lower abdominal aorta and renal arteries. Treatment in the majority of these cases was by graft inclusion technique with visceral vessel reattachment by direct suture of orifice to openings made in the graft. Intercostal and/or lumbar arteries were also reattached in some with the more extensive lesions. Aortic and renal artery occlusion times varied from 15 to 155 minutes. Paraplegia developed in five patients with the more extensive lesions but was reduced to one-third and made less severe by reattaching intercostal and lumbar arteries. Renal dysfunction was mild in four patients and severe in three patients after operation. All these were transient except one who died while recovering from renal failure. The latter cases were those difficult to reattach or were not initially successful and required reoperation. Of the 82 patients, 77 (94%) survived operation and long-term follow-up was obtained in 95% of cases, 23 performed over five years ago. Actuarial curves were constructed and compared to survival curves following simple infrarenal abdominal aortic resection. The survival rate both immediately and at six years, were the same.

ANEURYSMAL DISEASE of the aorta rarely involves the segment of abdominal aorta from which the renal, superior mesenteric, and celiac axis arise. When these vessels are involved, the aneurysm may be thoracoabdominal, involving segments of varying length of the descending thoracic aorta and abdominal aorta, or it may be truly abdominal in location, being confined to the aortic segment below the diaphragm involving one or more of these arteries. These aneurysms pose the most difficult challenge to treatment, owing to the difficulties of exposure, th of visceral organ ischer technical problem of ac needed for permanent avoidance of paraplegi both during and after

The feasibility of was demonstrated fi patient with lower ab volved the origin of volved renal artery attached in July 19 graft arising from t 1954, Etheredge ar a large upper abdo celiac and superio homograft to wh superior mesente The region of ope ing excision and October 1955, replaced a mo distal thoracic a origins of the ce arteries.[12] Rec using a tempo aortic homog which were st after the ane DeBakey intr aortic bypas propriately tubes in a clusion tim occlusion

Presented at the 98th Annual Meeting of the American Surgical Association, Dallas, Texas, April 27, 1978.





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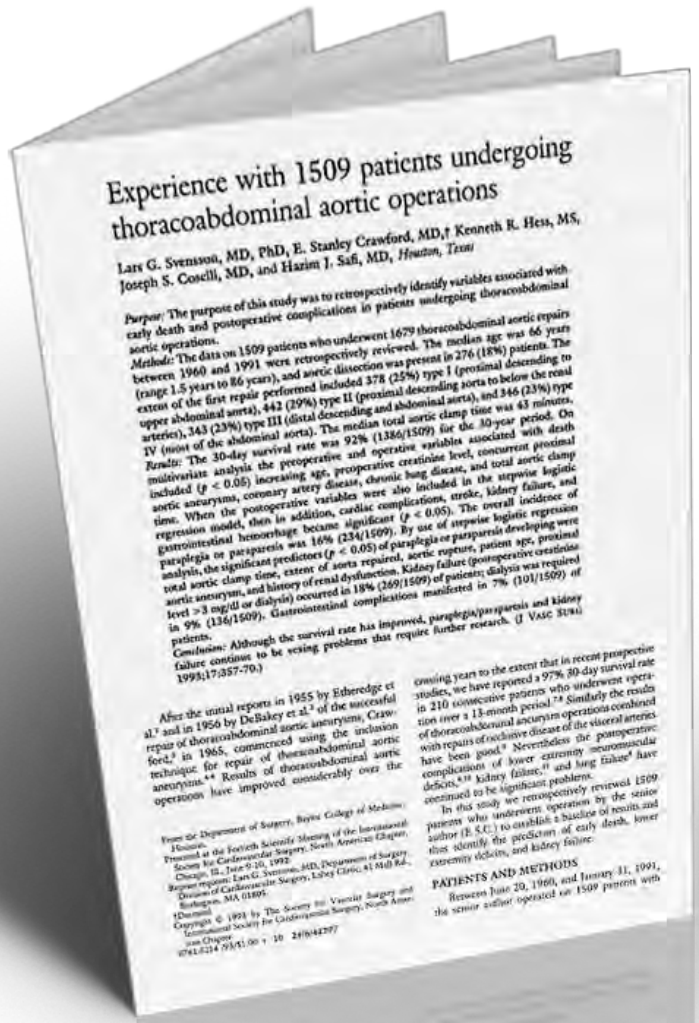

Experience with 1509 patients undergoing thoracoabdominal aortic operations

Lars G. Svensson, MD, PhD, E. Stanley Crawford, MD,† Kenneth R. Hess, MS, Joseph S. Coselli, MD, and Hazim J. Safi, MD, *Houston, Texas*

Purpose: The purpose of this study was to retrospectively identify variables associated with early death and postoperative complications in patients undergoing thoracoabdominal aortic operations.

Methods: The data on 1509 patients who underwent 1679 thoracoabdominal aortic repairs between 1960 and 1991 were retrospectively reviewed. The median age was 66 years (range 1.5 years to 86 years), and aortic dissection was present in 276 (18%) patients. The extent of the first repair performed included 378 (25%) type I (proximal descending to upper abdominal aorta), 442 (29%) type II (proximal descending aorta to below the renal arteries), 343 (23%) type III (distal descending and abdominal aorta), and 346 (23%) type IV (most of the abdominal aorta). The median total aortic clamp time was 43 minutes.

Results: The 30-day survival rate was 92% (1386/1509) for the 30-year period. On multivariate analysis the preoperative and operative variables associated with death included ($p < 0.05$) increasing age, preoperative creatinine level, concurrent proximal aortic aneurysms, coronary artery disease, chronic lung disease, and total aortic clamp time. When the postoperative variables were also included in the stepwise logistic regression model, then in addition, cardiac complications, stroke, kidney failure, and gastrointestinal hemorrhage became significant ($p < 0.05$). The overall incidence of paraplegia or paraparesis was 16% (234/1509). By use of stepwise logistic regression analysis, the significant predictors ($p < 0.05$) of paraplegia or paraparesis developing were total aortic clamp time, extent of aorta repaired, aortic rupture, patient age, proximal aortic aneurysm, and history of renal dysfunction. Kidney failure (postoperative creatinine level >3 mg/dl or dialysis) occurred in 18% (269/1509) of patients; dialysis was required in 9% (136/1509). Gastrointestinal complications manifested in 7% (101/1509) of patients.

Conclusion: Although the survival rate has improved, paraplegia/paraparesis and kidney failure continue to be vexing problems that require further research. (J Vasc Surg 1993;17:357-70.)

After the initial reports in 1955 by Etheredge et al.[1] and in 1956 by DeBakey et al.[2] of the successful repair of thoracoabdominal aortic aneurysms, Crawford,[3] in 1965, commenced using the inclusion technique for repair of thoracoabdominal aortic aneurysms.[4-6] Results of thoracoabdominal aortic operations have improved considerably over the ensuing years to the extent that in recent prospective studies, we have reported a 97% 30-day survival rate in 210 consecutive patients who underwent operation over a 13-month period.[7,8] Similarly the results of thoracoabdominal aneurysm operations combined with repairs of occlusive disease of the visceral arteries have been good.[9] Nevertheless the postoperative complications of lower extremity neuromuscular deficits,[8,10] kidney failure,[11] and lung failure[4] have continued to be significant problems.

In this study we retrospectively reviewed 1509 patients who underwent operation by the senior author (E.S.C.) to establish a baseline of results and thus identify the predictors of early death, lower extremity deficits, and kidney failure.

PATIENTS AND METHODS

Between June 20, 1960, and January 31, 1991, the senior author operated on 1509 patients with

From the Department of Surgery, Baylor College of Medicine, Houston.

Presented at the Fortieth Scientific Meeting of the International Society for Cardiovascular Surgery, North American Chapter, Chicago, Ill., June 9-10, 1992.

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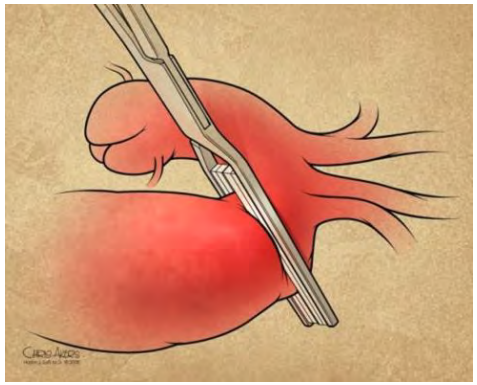
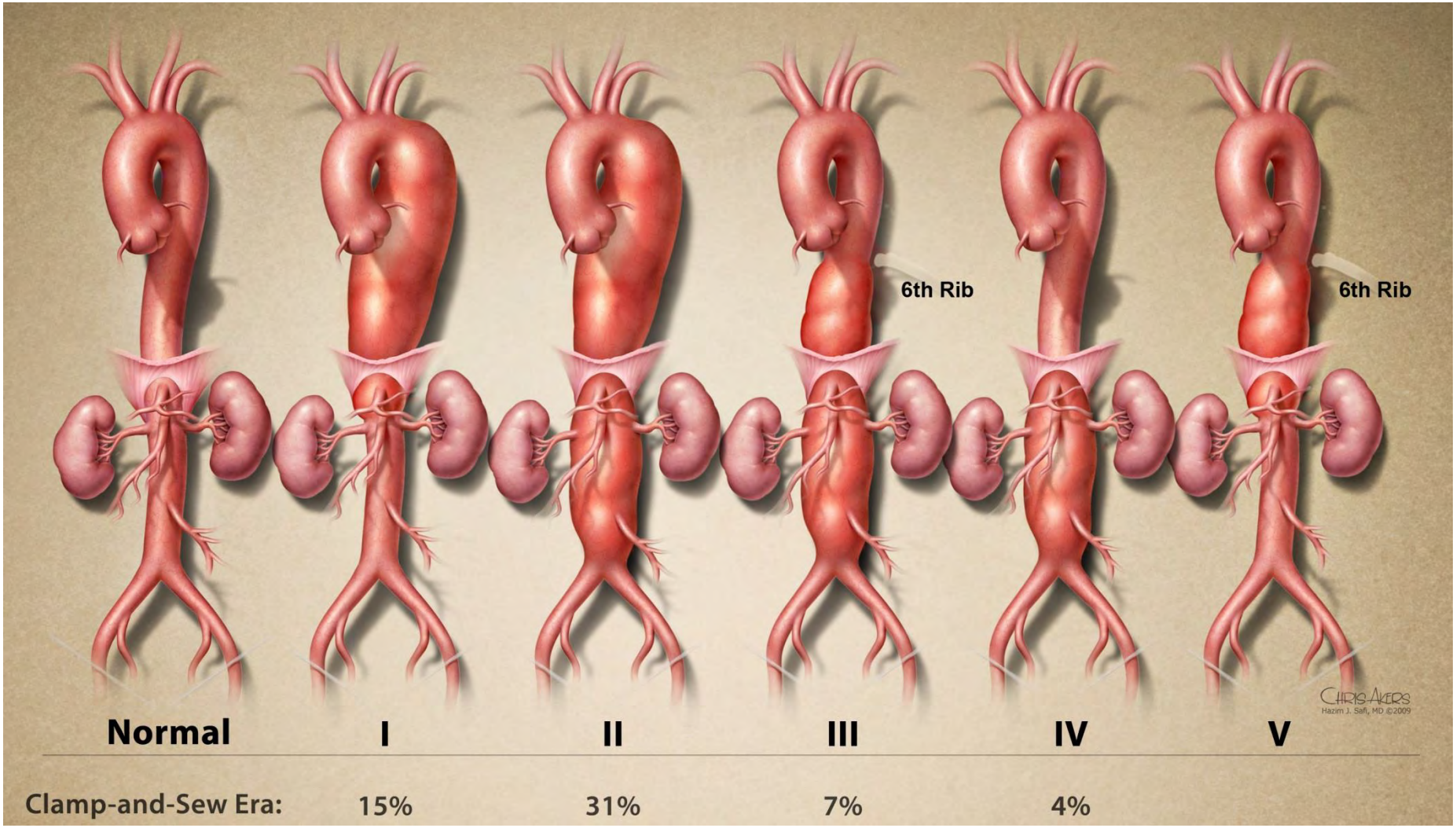


SCI - Clamp and Go

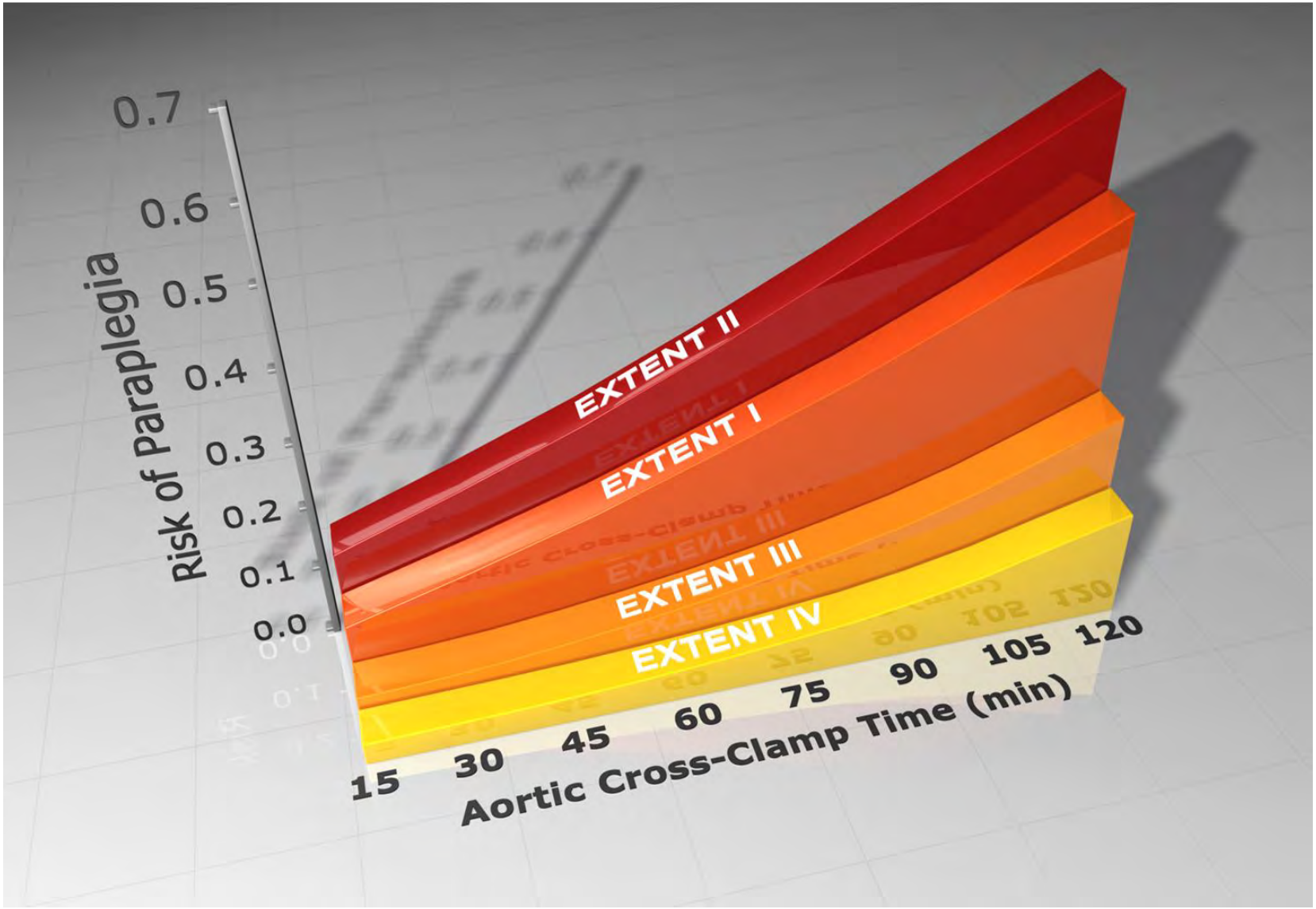
Extent	<0.0001
Aortic Clamp Time	<0.0001
Rupture	0.0073
Age	0.025
Proximal Aneurysm	0.034
Renal Dysfunction	0.040

1993

SCI - Clamp & Sew Era

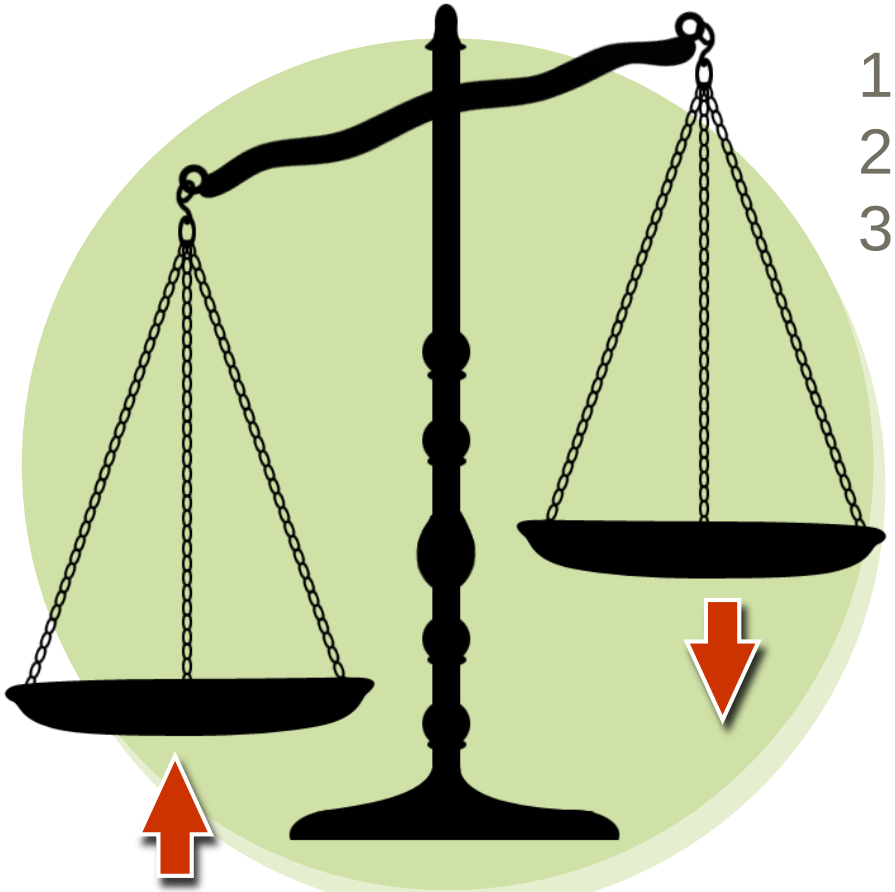


Clamp and Go Era



Rationale for Spinal Cord Protection

Spinal Cord Protection



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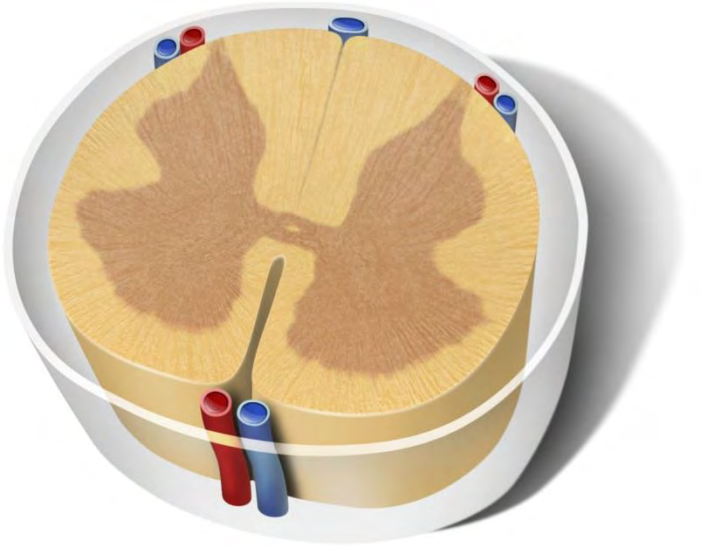

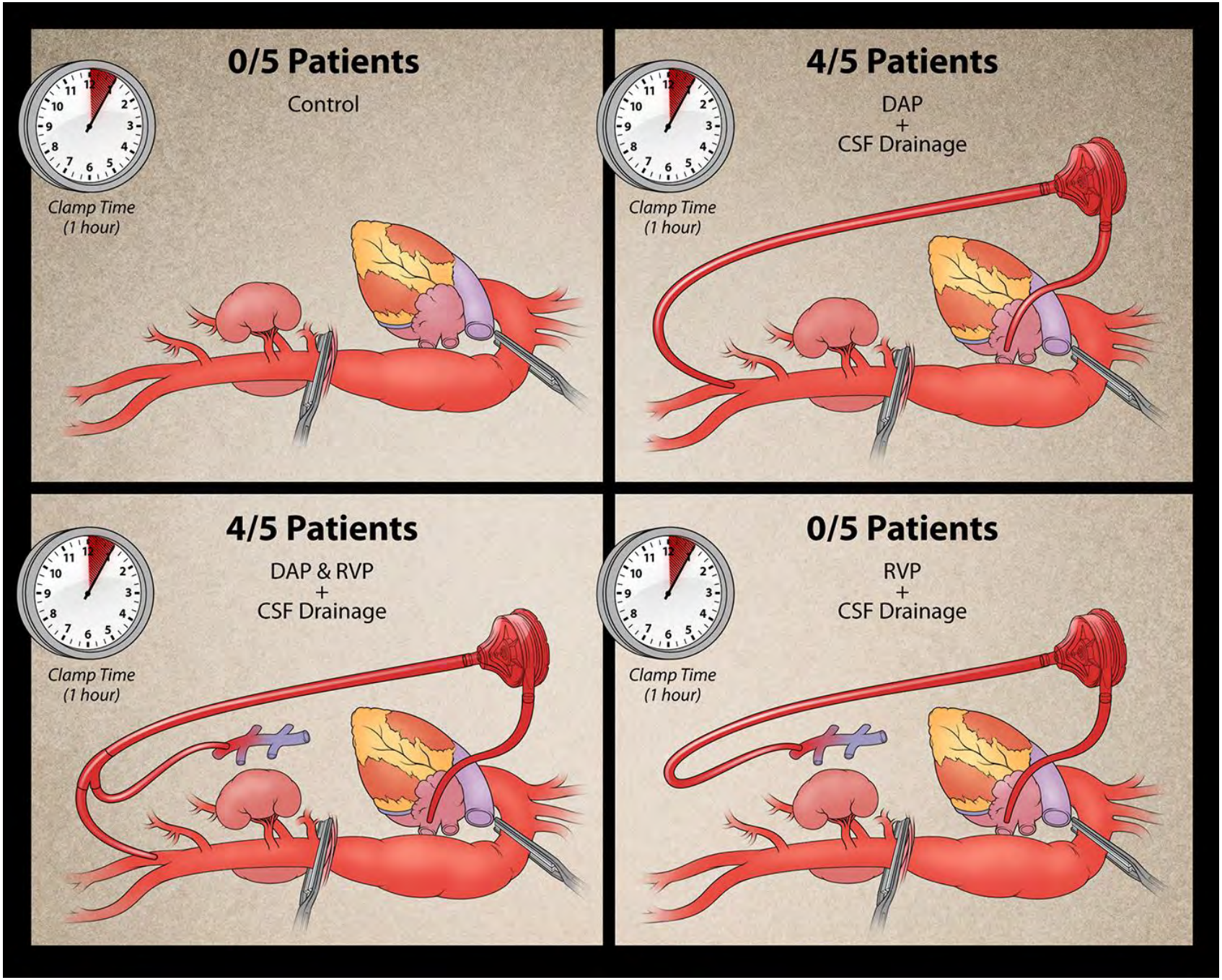
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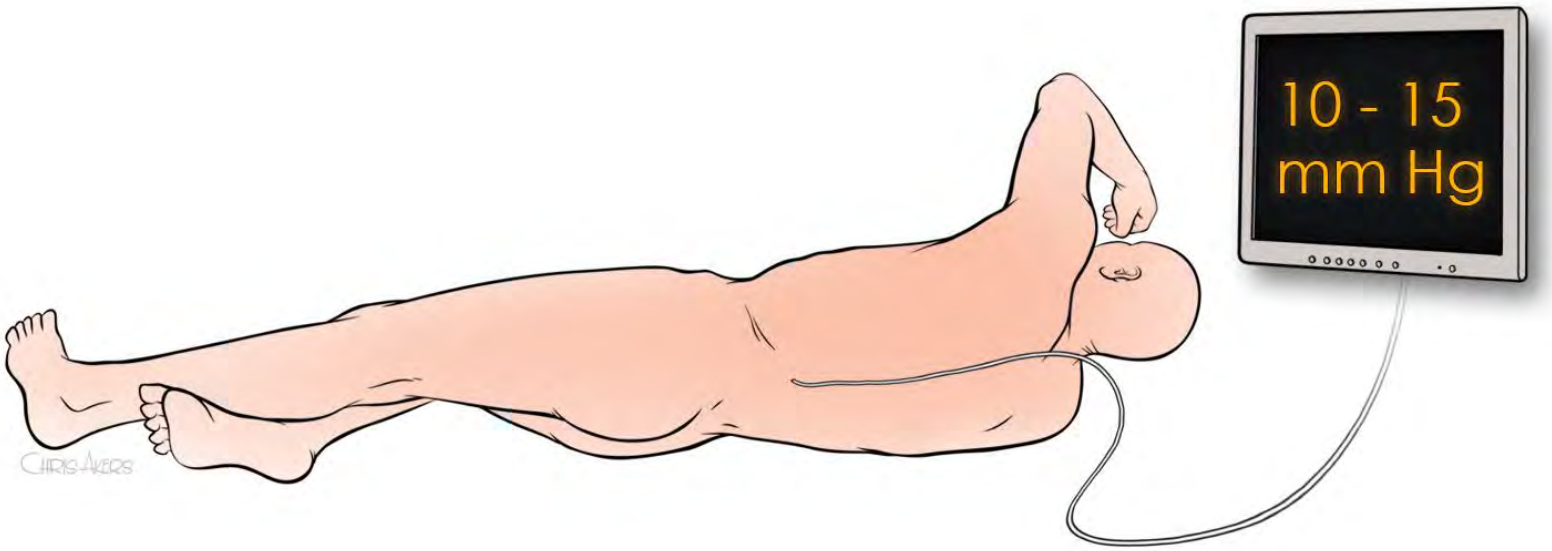
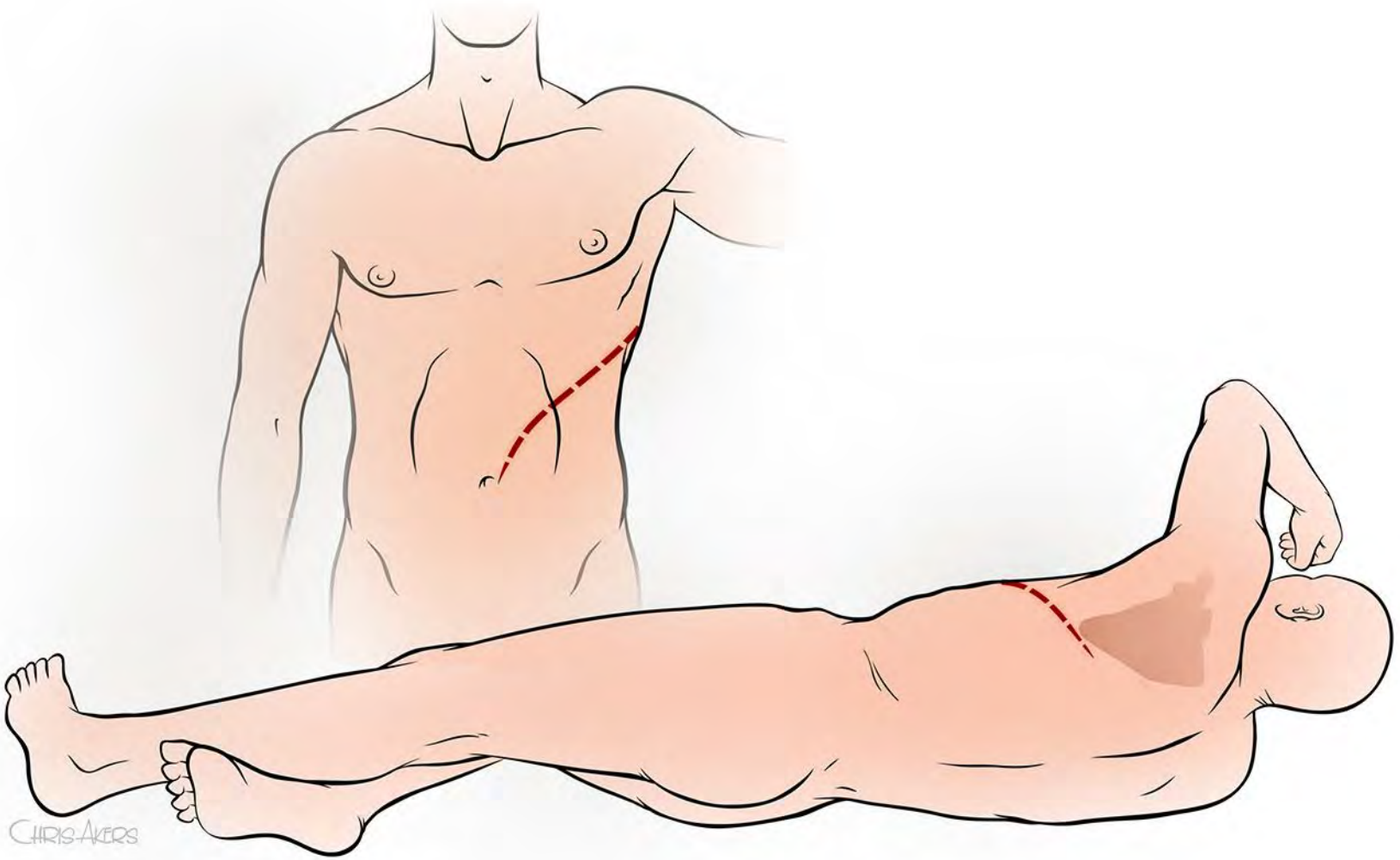
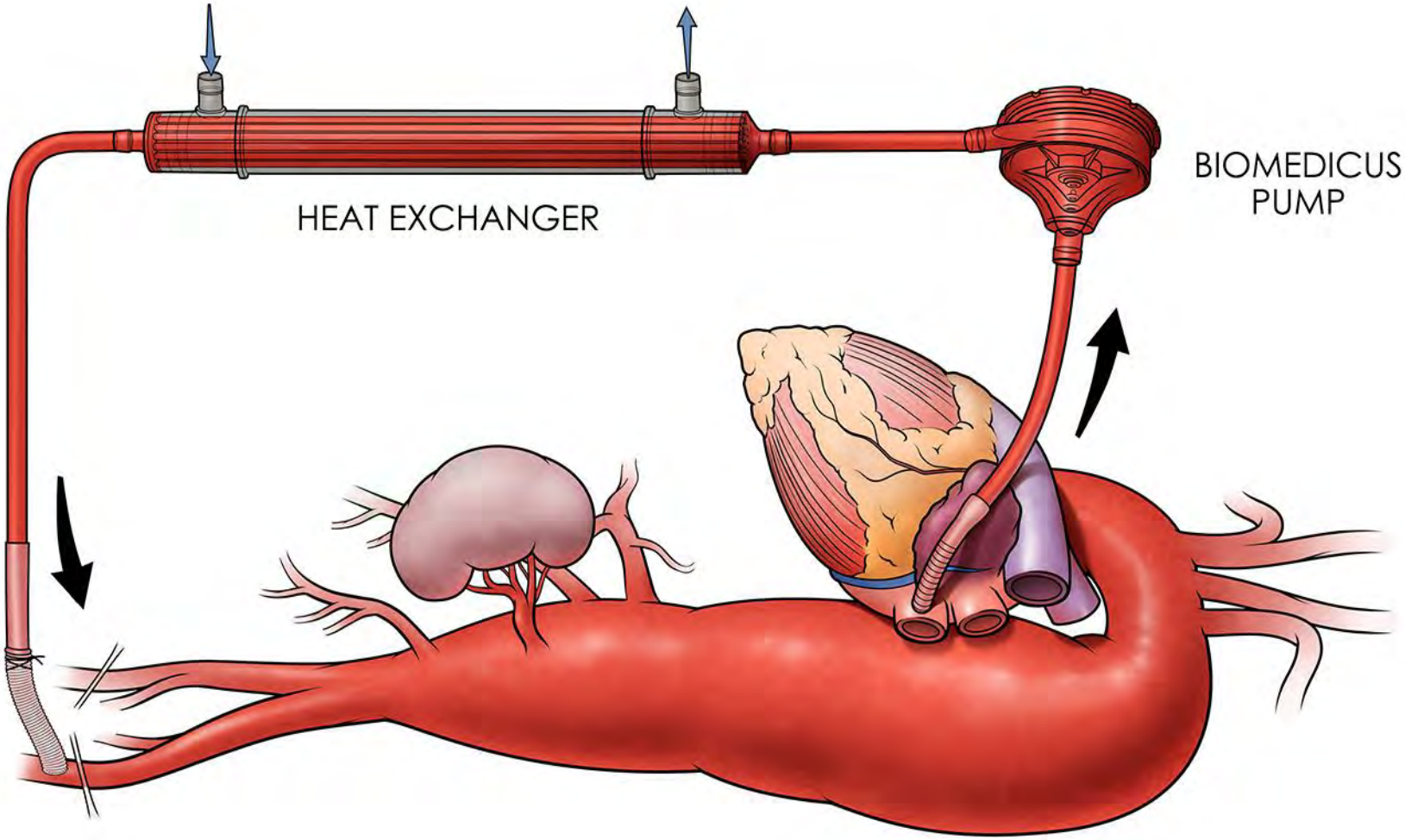
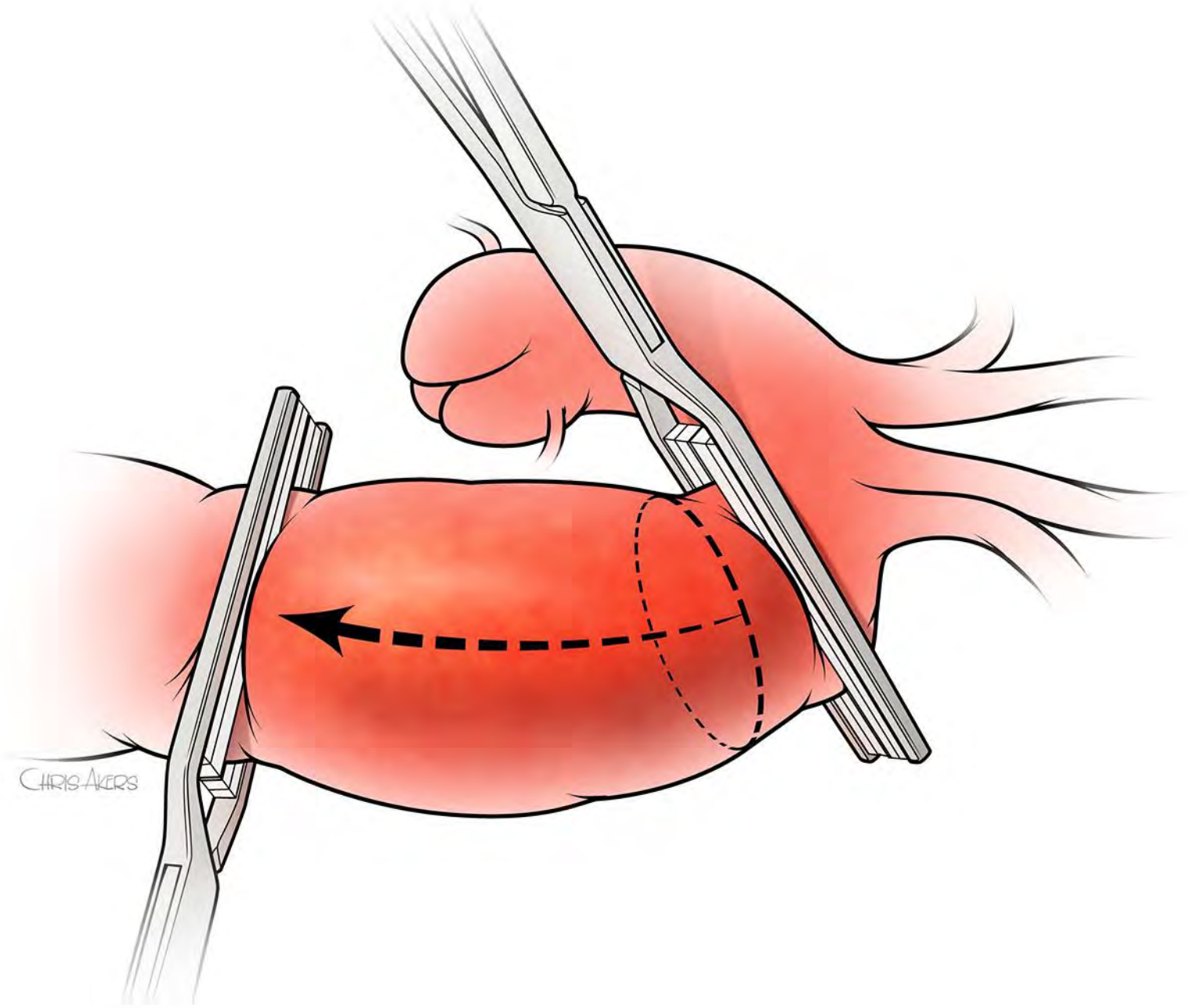
CSF Drainage




CHRIS-AKERS


HEAT EXCHANGER
BIOMEDICUS
PUMP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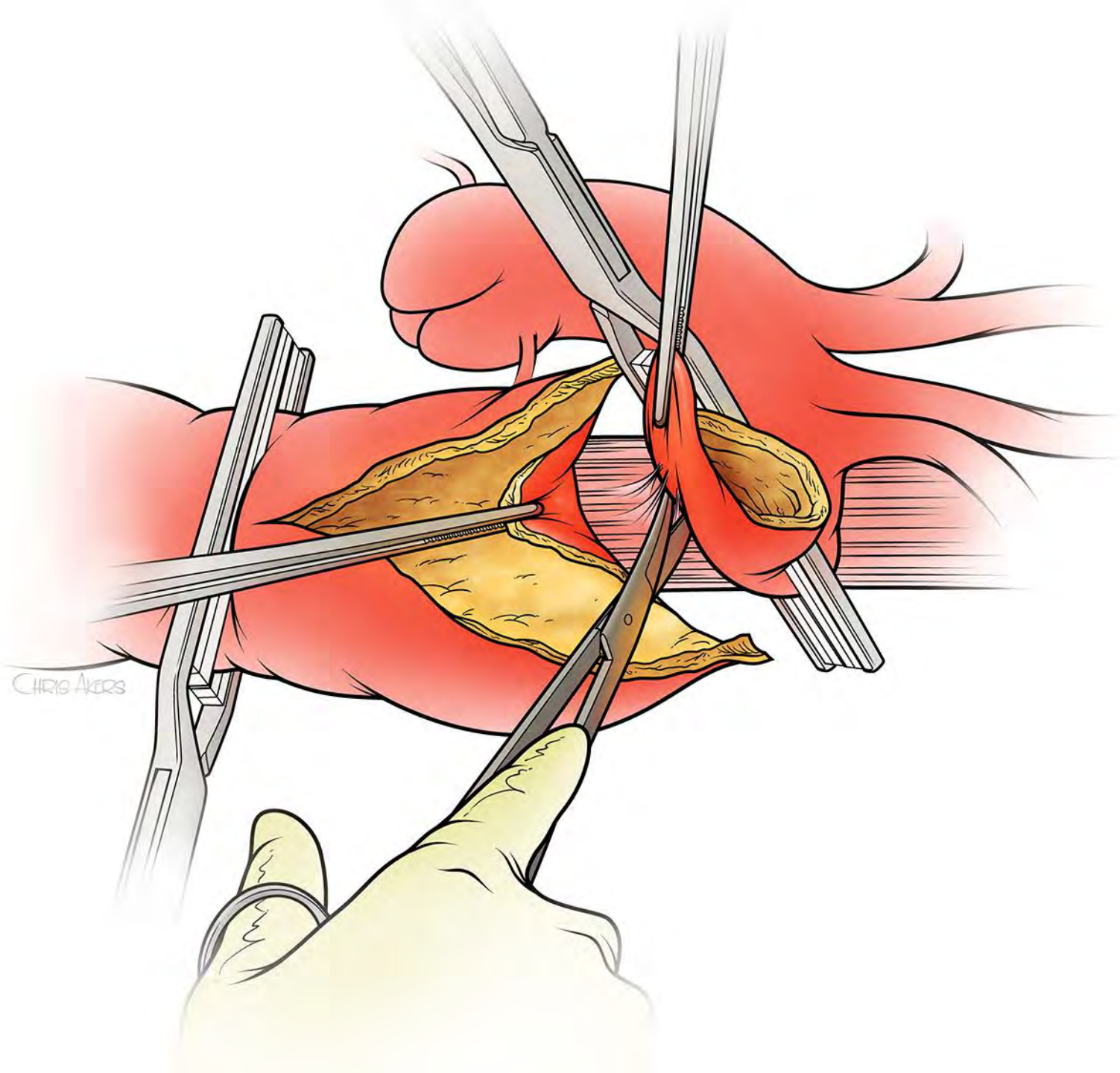
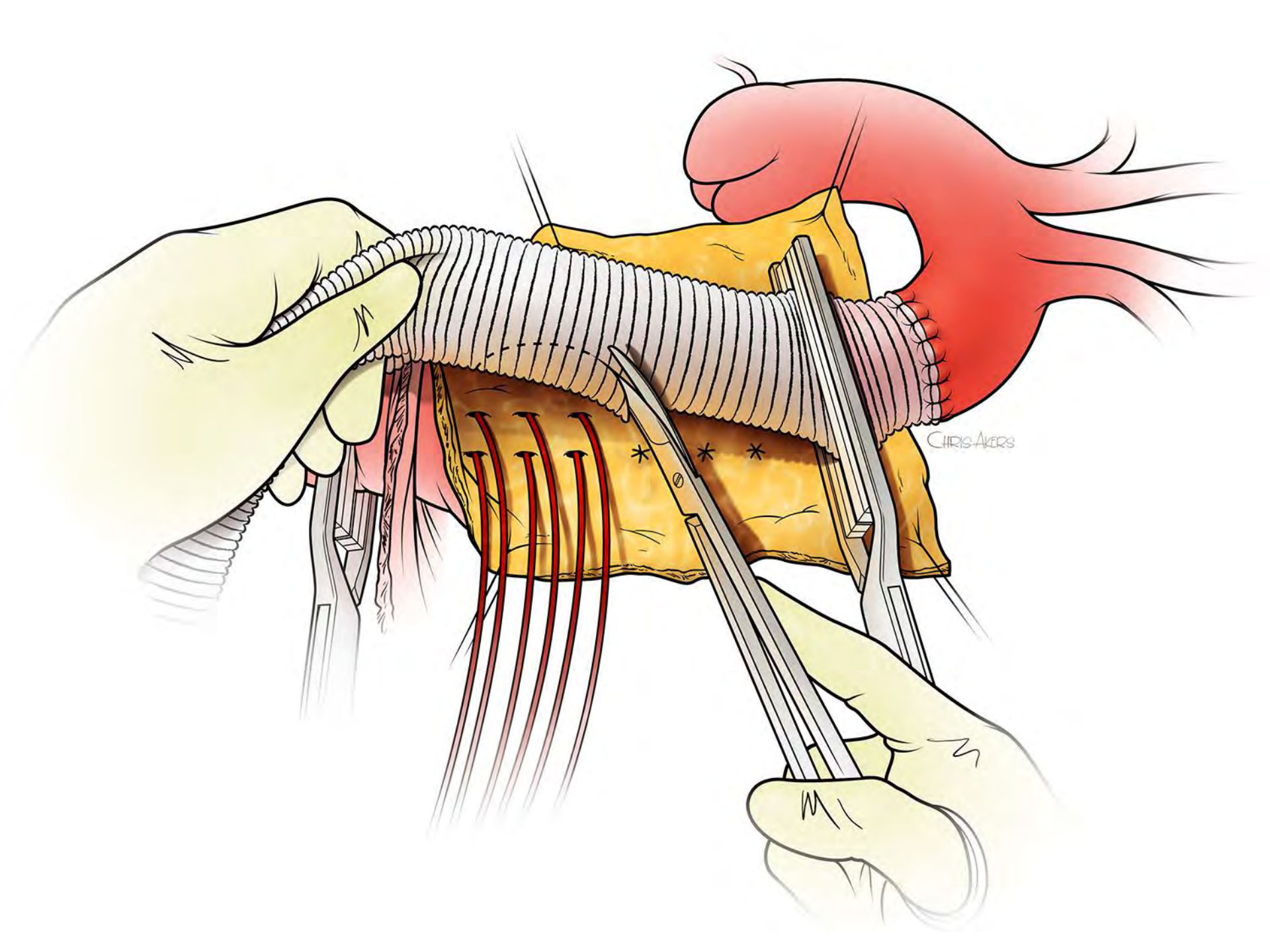

Chris Akers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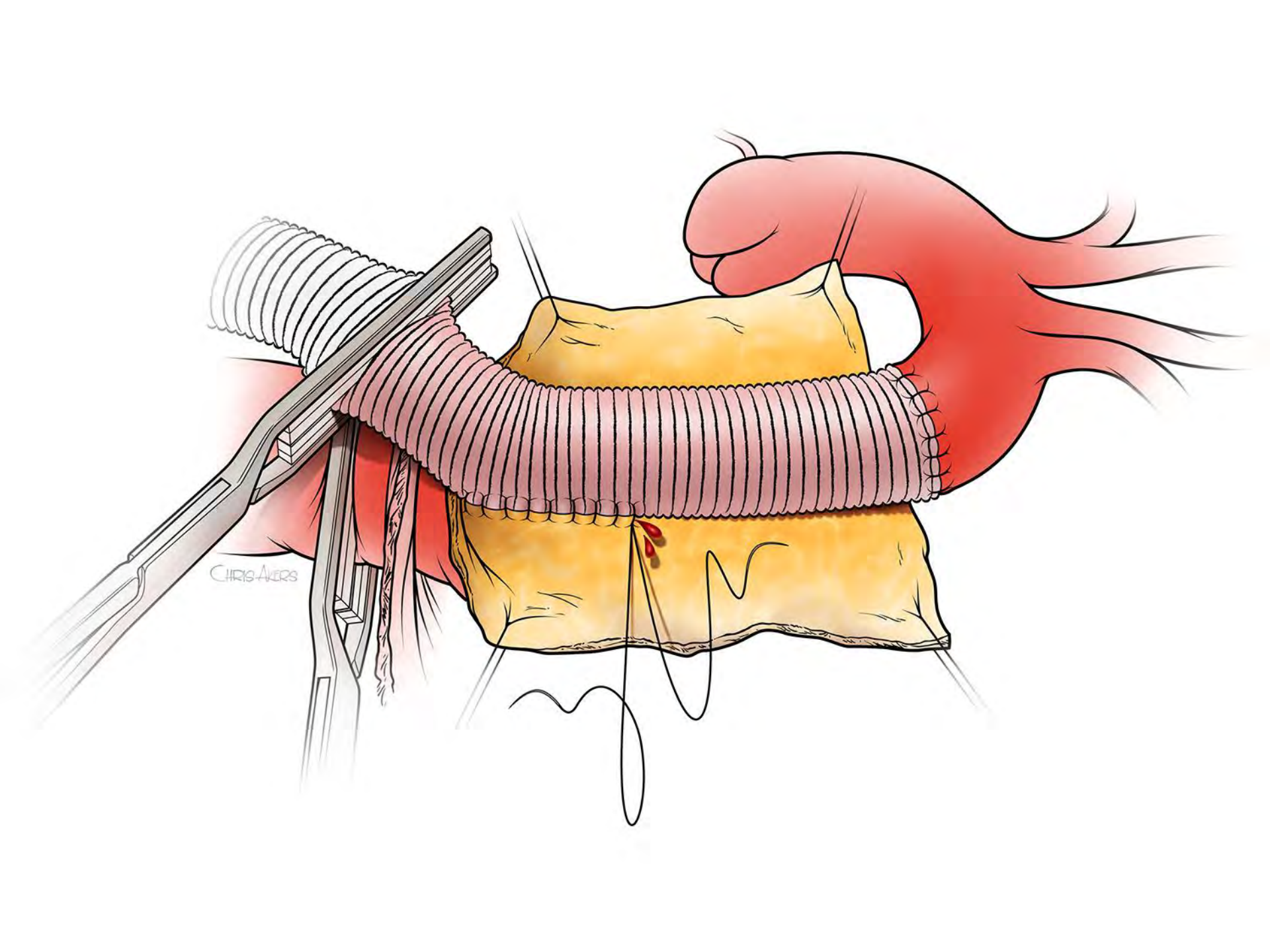
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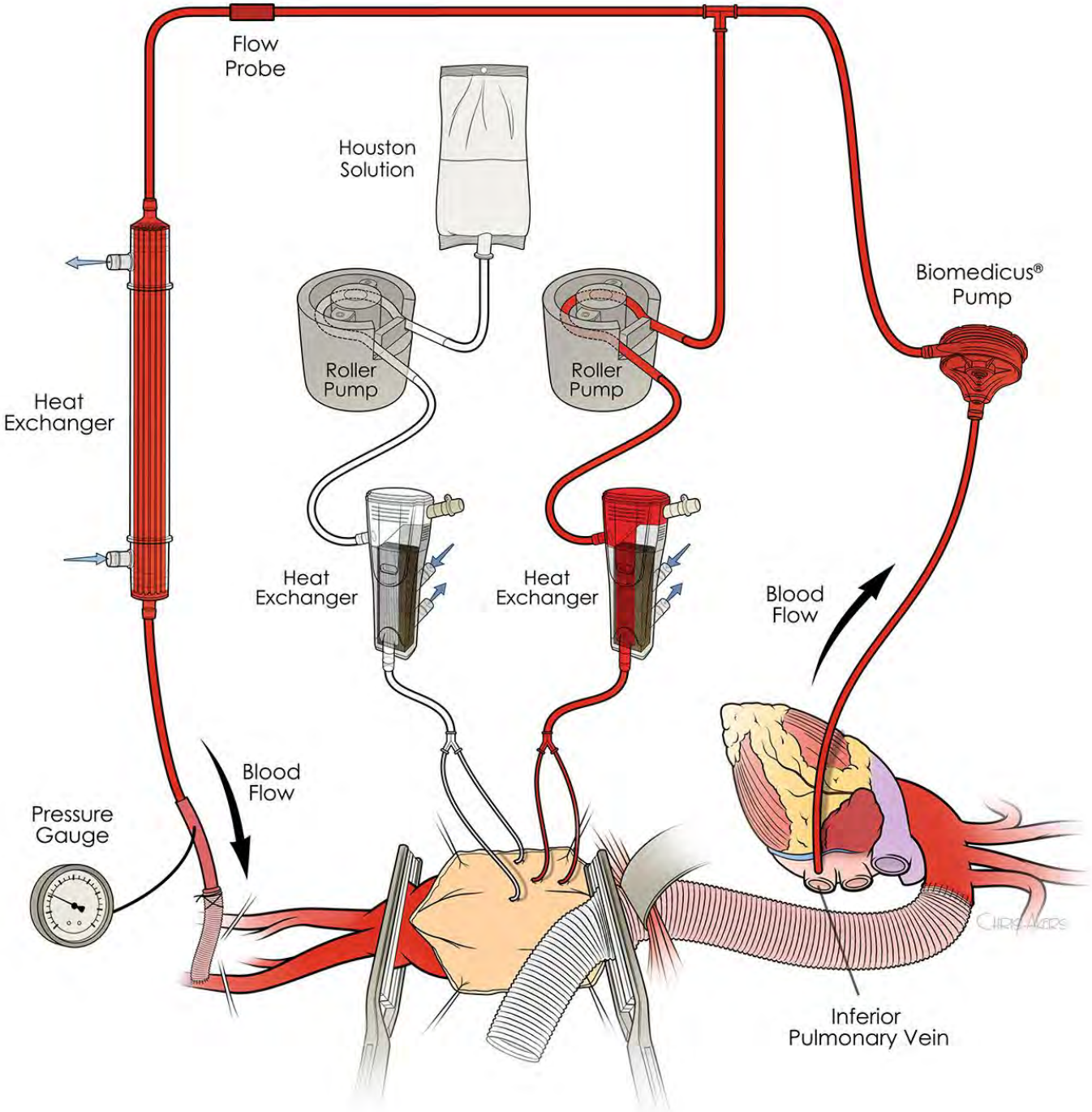
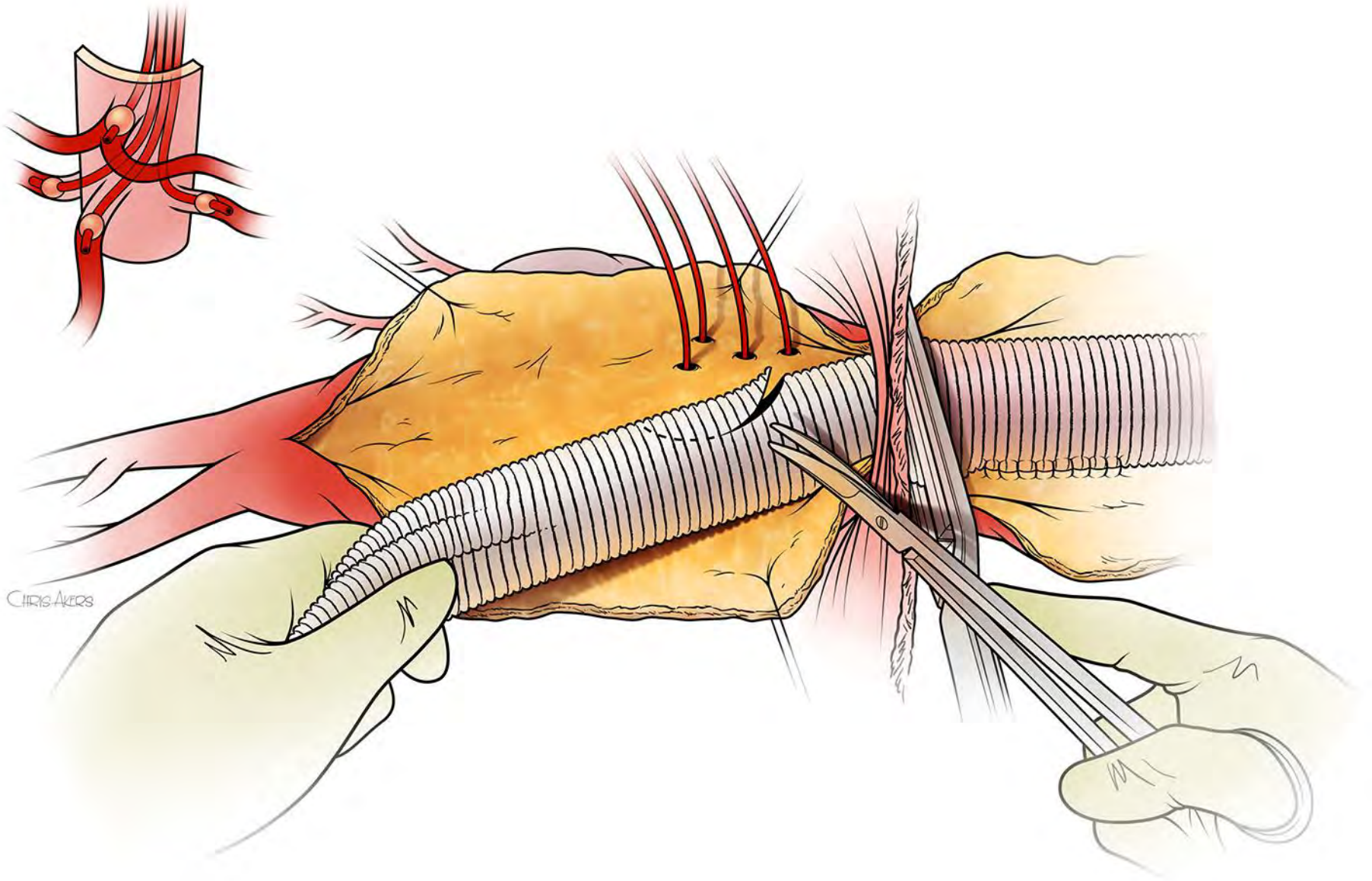

Flow
Probe
Houston
Solution
Biomedicus®
Pump
Roller
Pump
Roller
Pump
Heat
Exchanger
Heat
Exchanger
Heat
Exchanger
Blood
Flow
Blood
Flow
Pressure
Gauge
Inferior
Pulmonary Vein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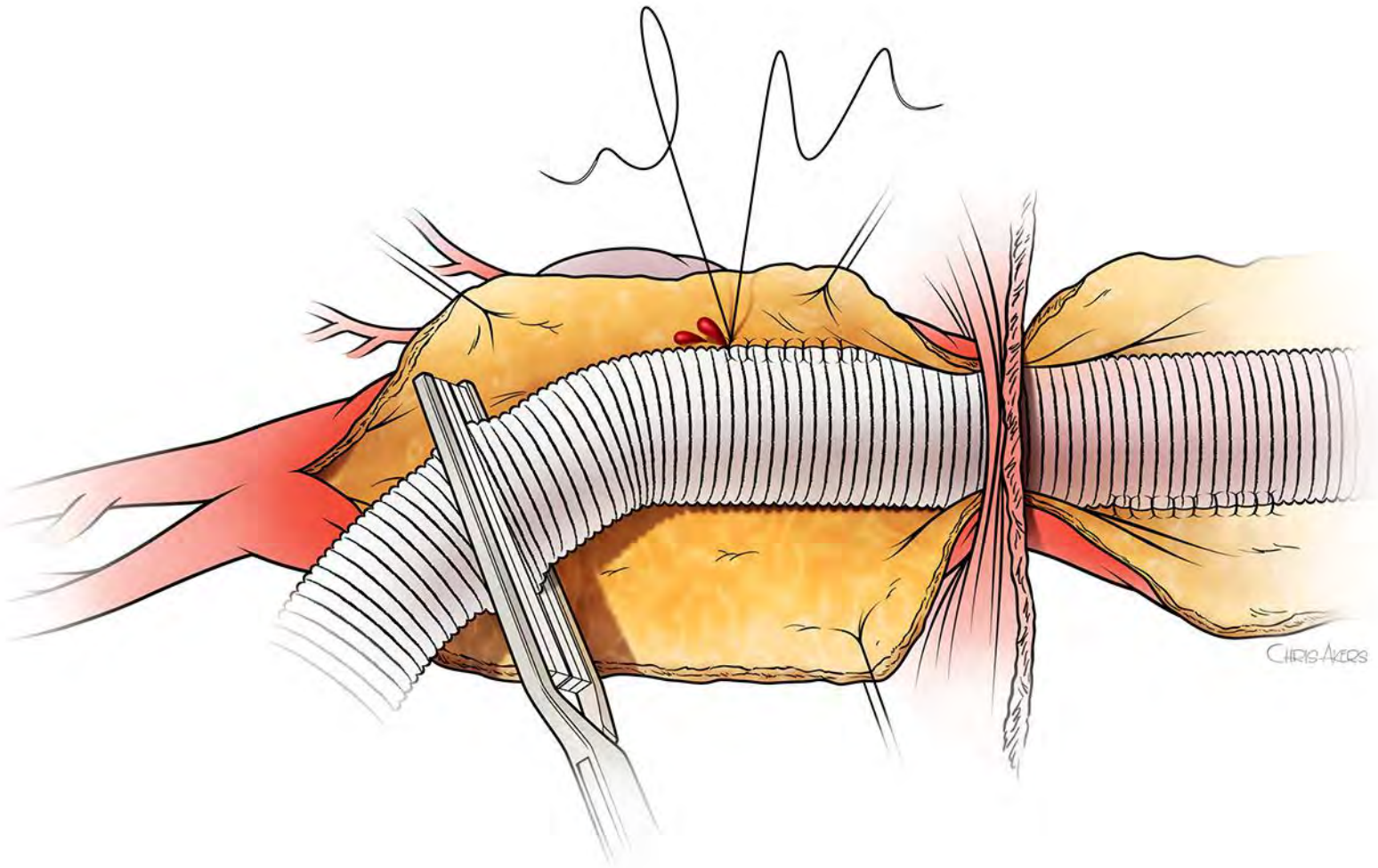
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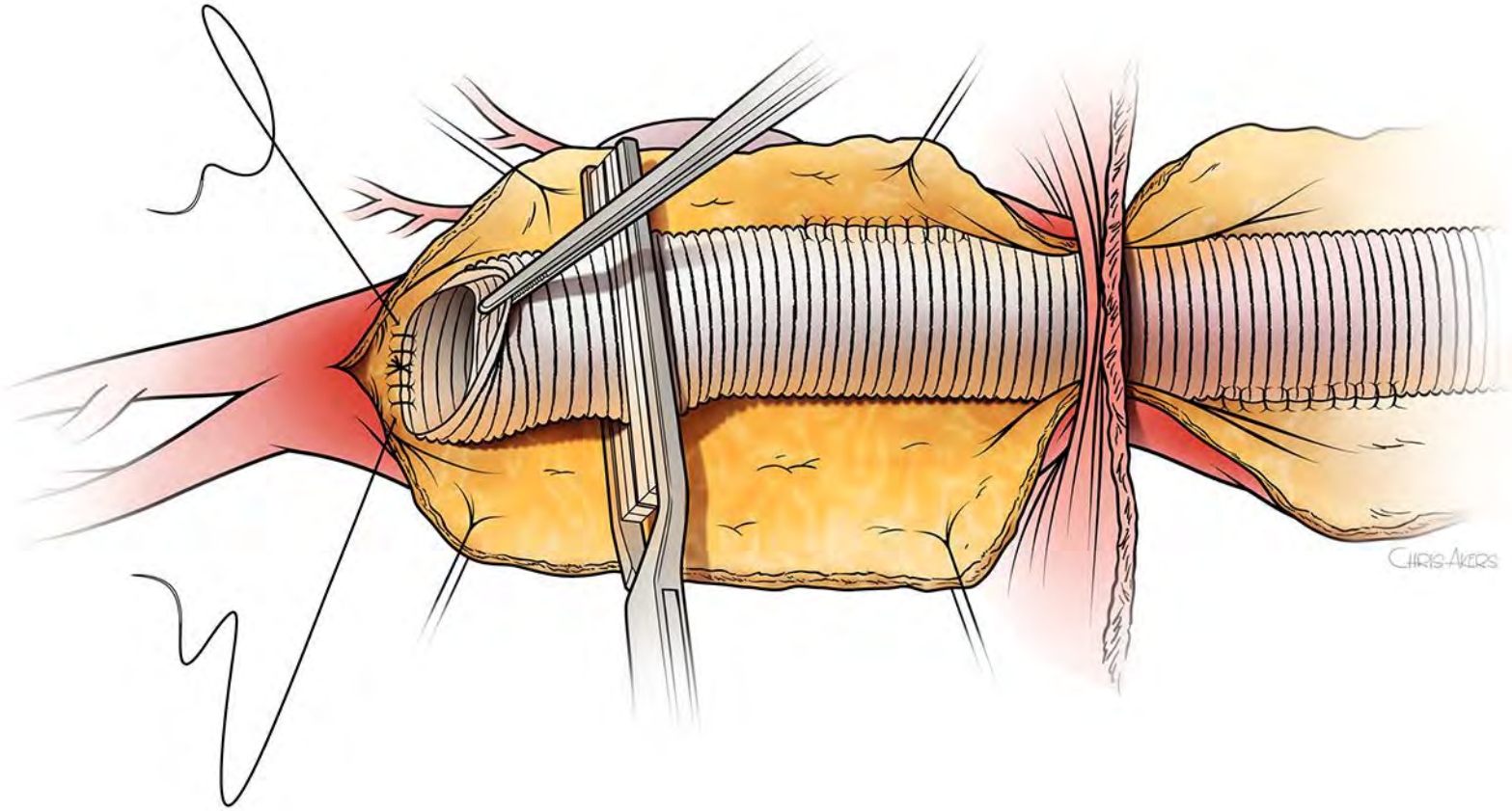
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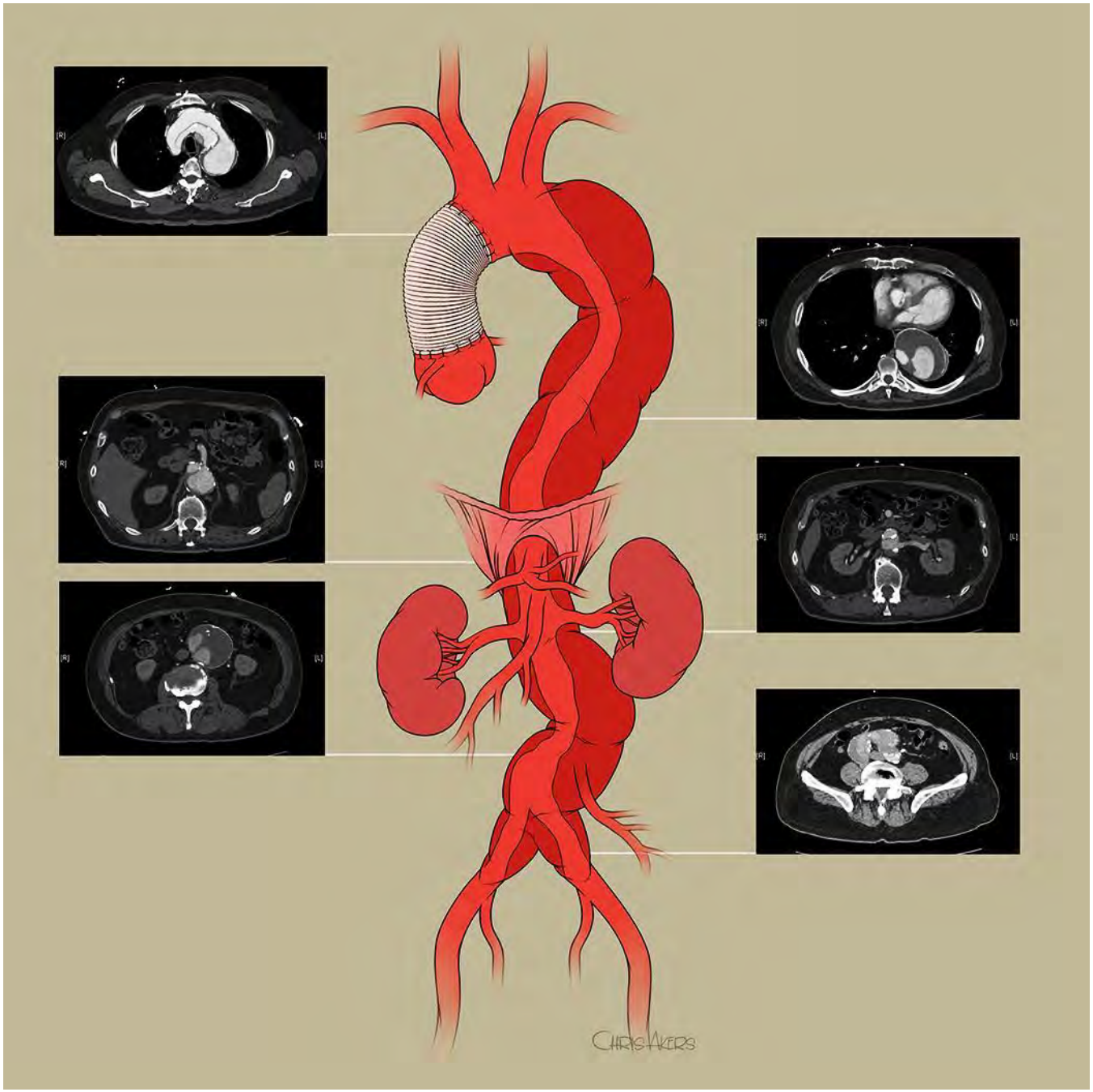
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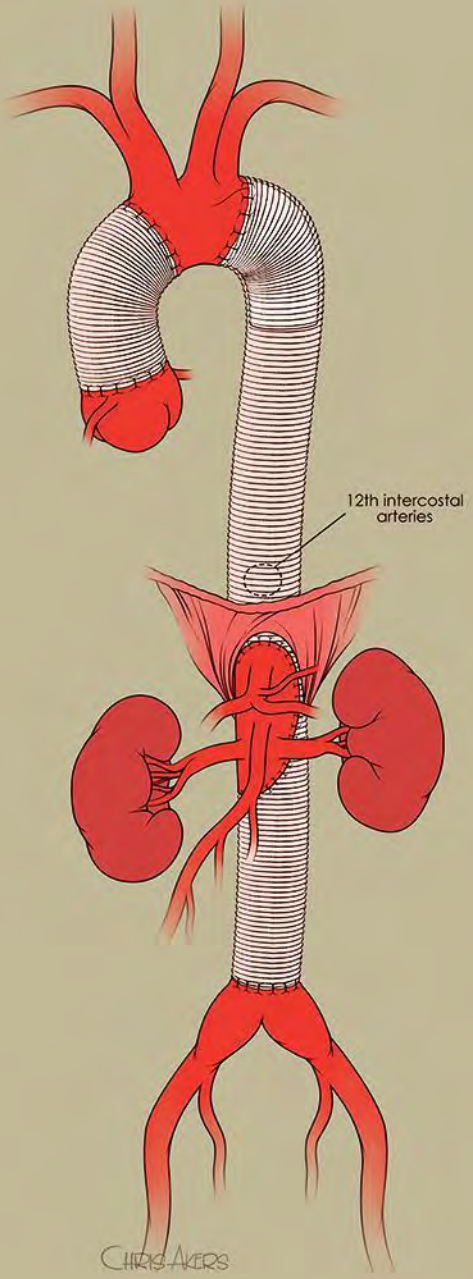
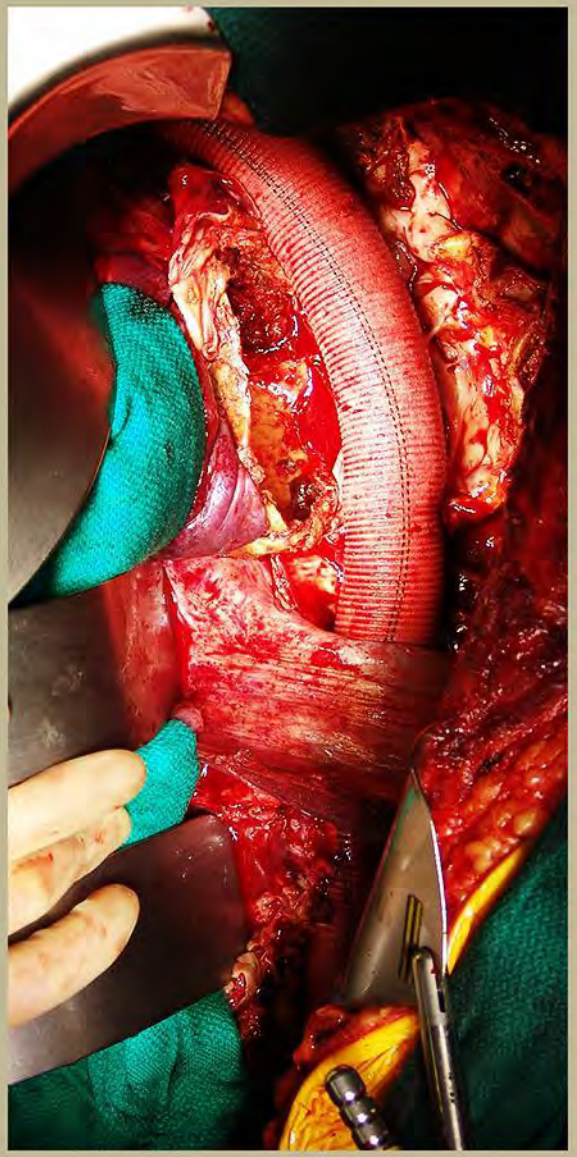
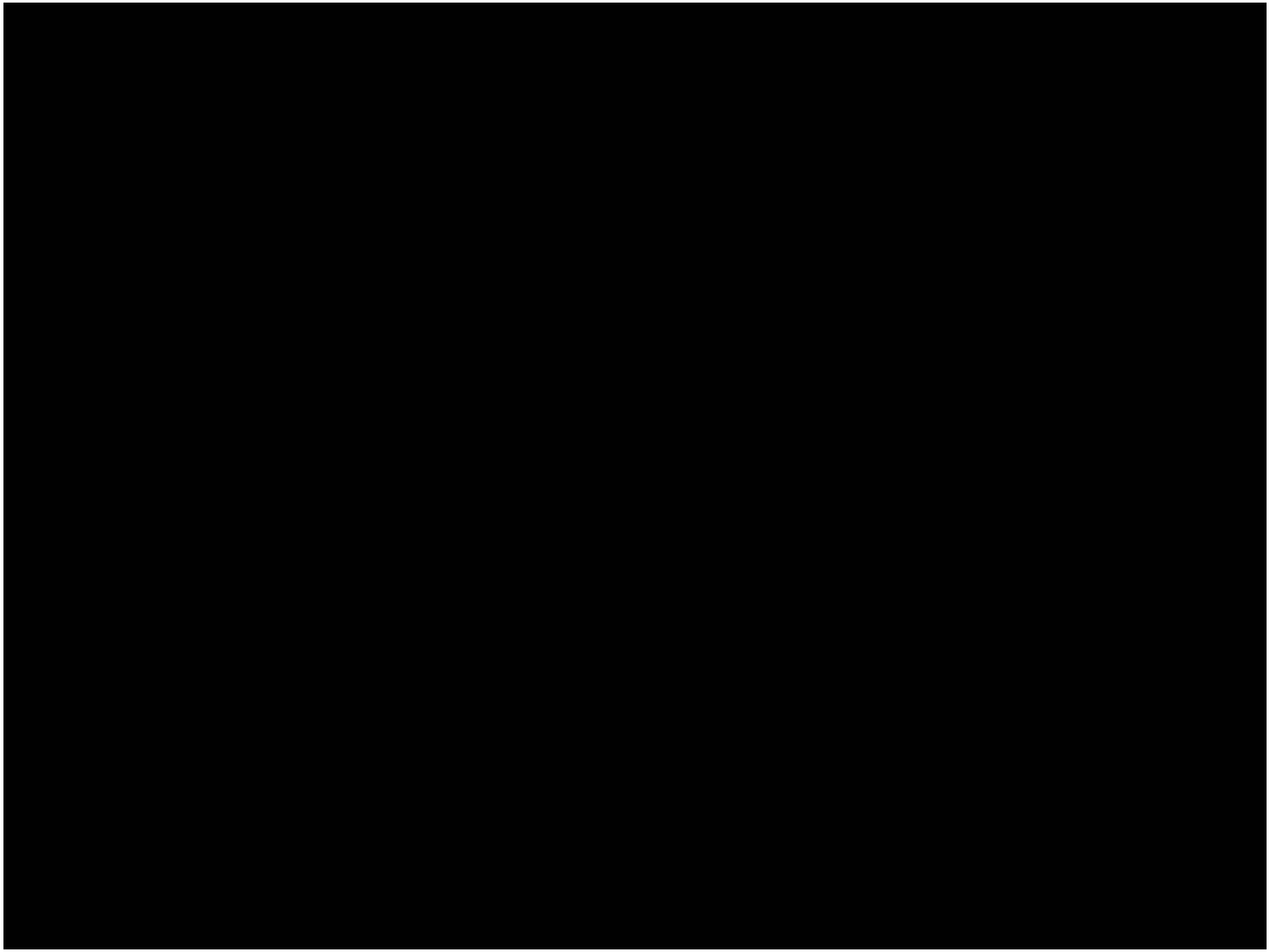
CHRIS AKERS


12th intercostal arteries
CHRIS AKERS






ASA PAPER

A Quarter Century of Organ Protection in Open Thoracoabdominal Repair

Anthony L. Estrera, MD, Harrison K. Sandhu, MD, MPH, Kristofer M. Charlton-Ouw, MD, Rama O. Afifi, MD, Ali Azizzadeh, MD, Charles C. Miller III, PhD, and Hazim J. Safi, MD

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1896 patients

Feb 1991 – Dec 2014

Mean age 64 ±13.8

63% 37%

Pre-Operative Characteristics

Variable	%
Smoking	32
Hypertension	73
Cerebrovascular Disease	11
Coronary Artery Disease	27
Renal Disease	19
Acute Dissection	4
Chronic Dissection	25

Operative Factors

Variable	
Intercostal Artery Reattachment	39%
Pump time	44 min
Aortic Cross-Clamp Time	46 min
Adjunct use	74%

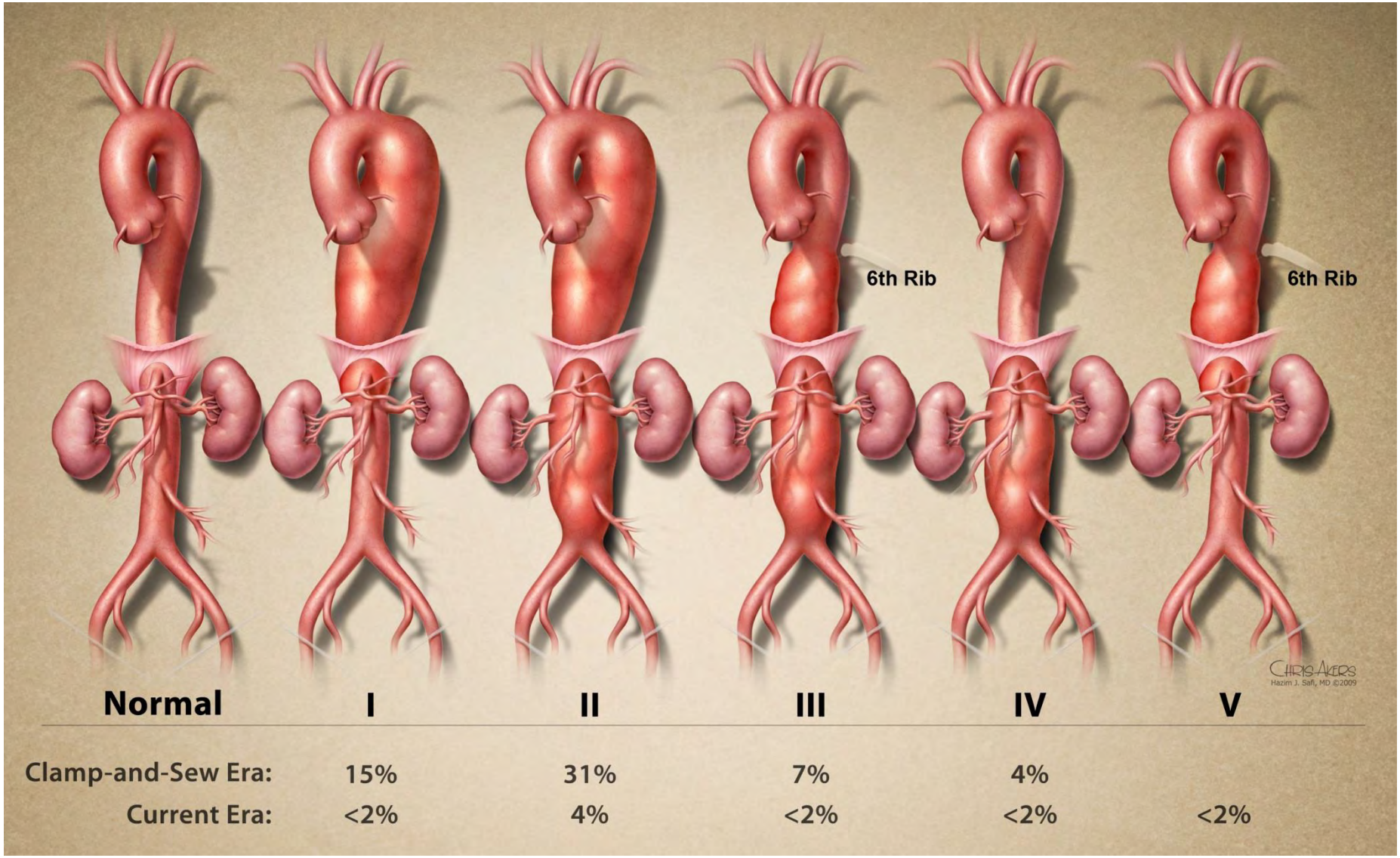
Results

Neurologic Deficit	β	P
Overall	79/1896	4.1%

Results

Neurologic Deficit	β	P
Decreasing GFR	-0.009	0.015
Adjunct	0.4855	0.326
Extent 2 or 3	2.434	0.0001
Interaction	-1.4917	0.014
X-Clamp Time	0.0094	0.036

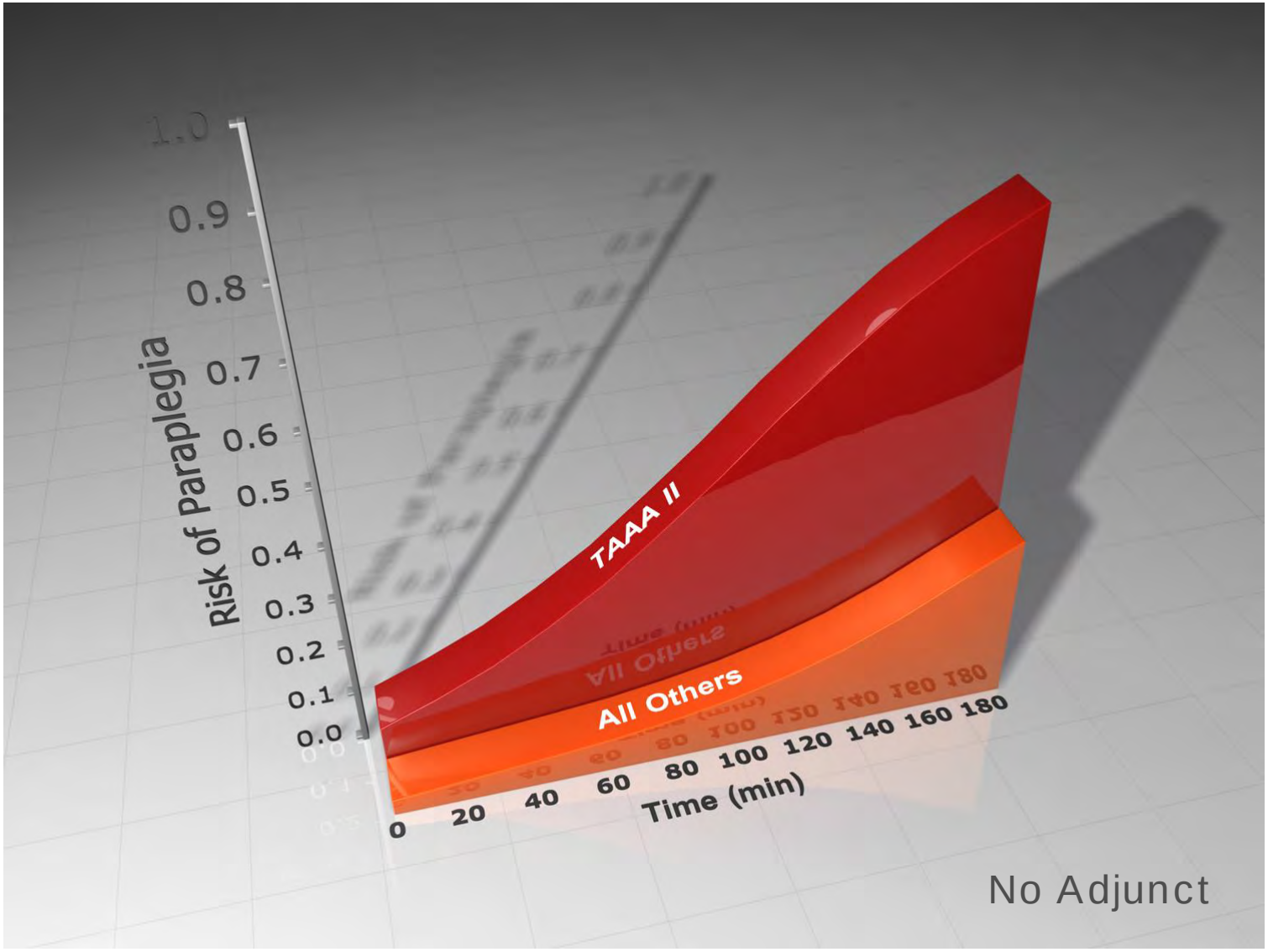
SCI – Modern Era



	Normal	I	II	III	IV	V
Clamp-and-Sew Era:		15%	31%	7%	4%	
Current Era:		<2%	4%	<2%	<2%	<2%

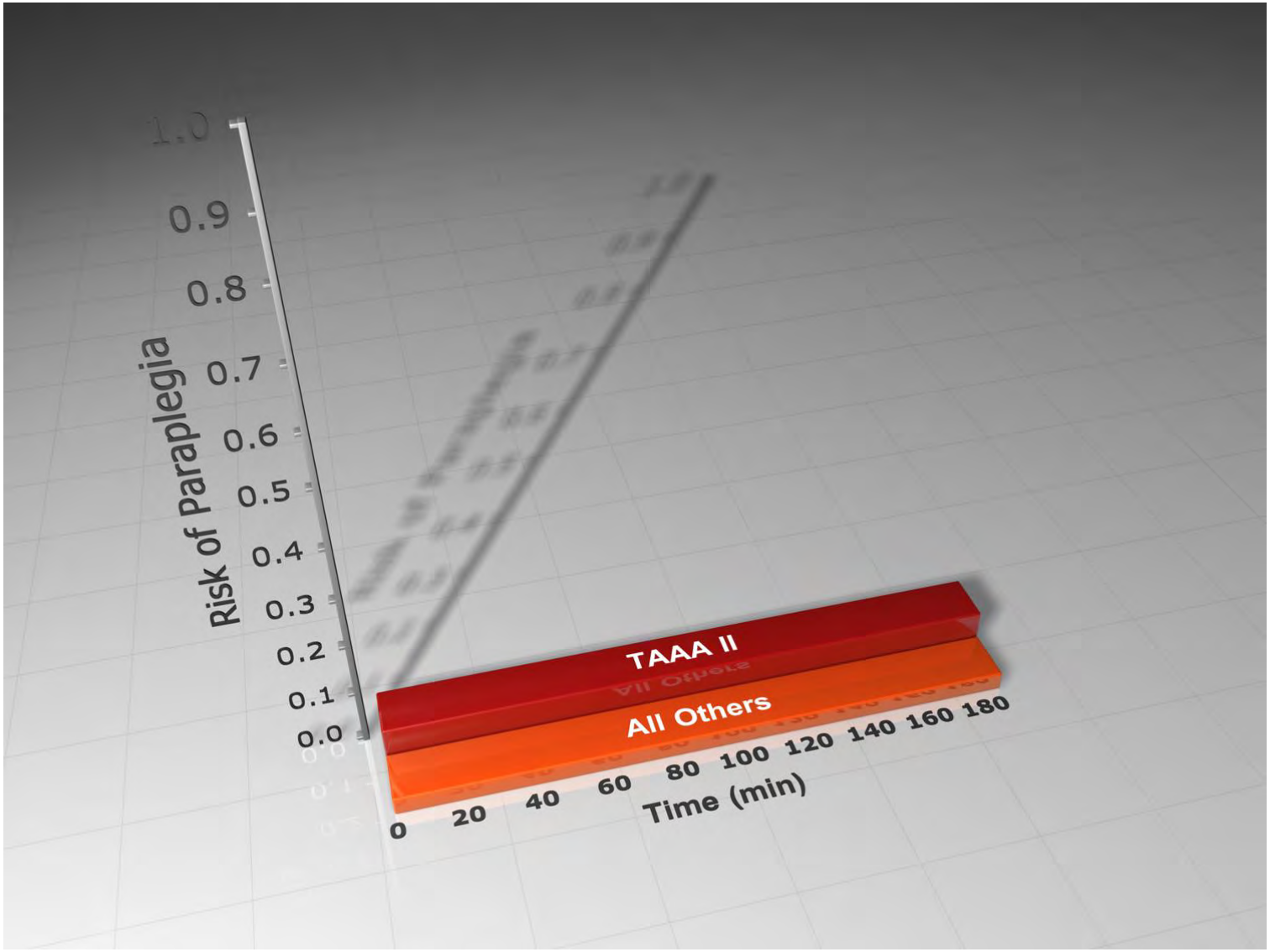
Neurologic Deficit

X-Clamp and Go Era



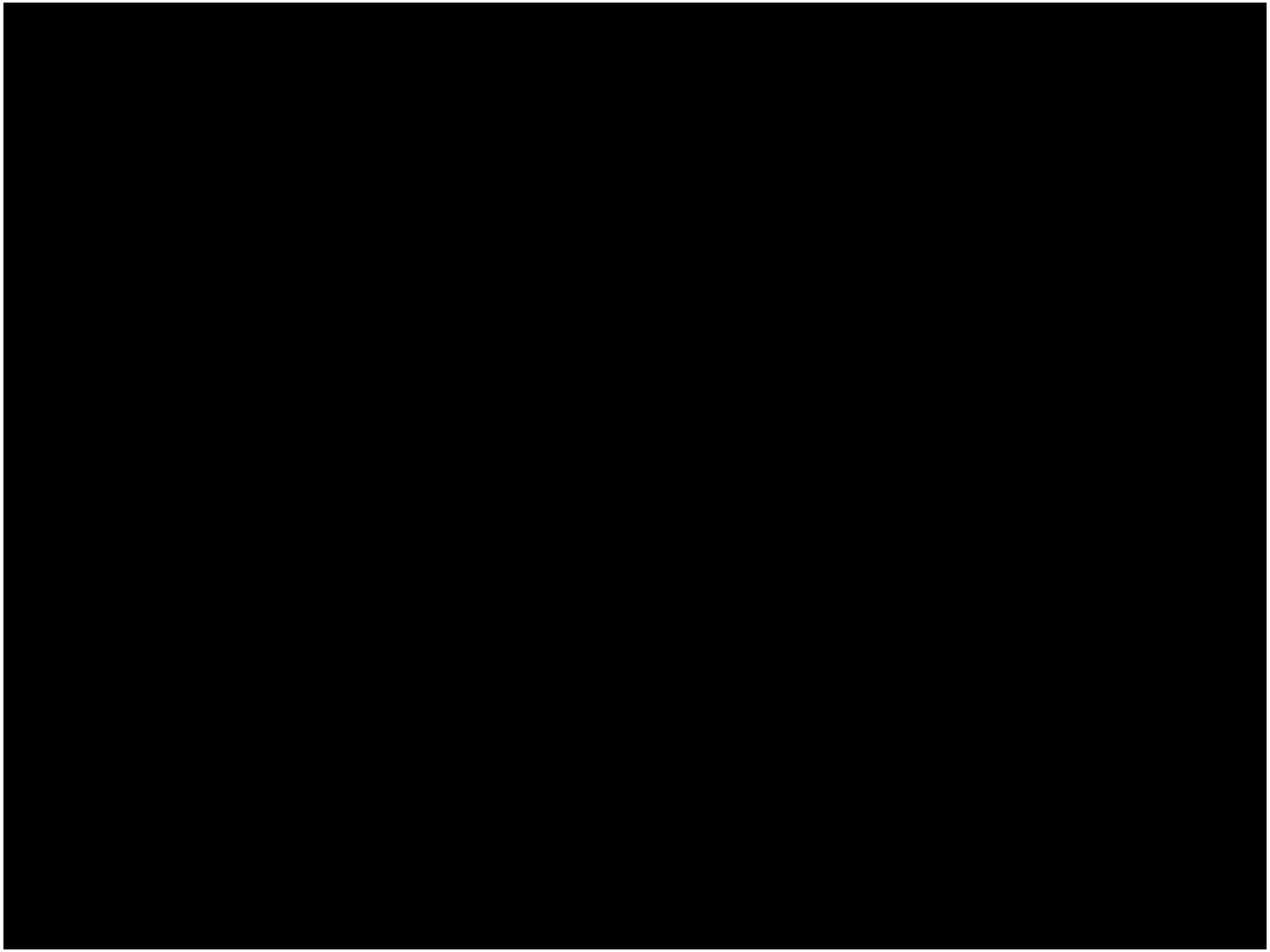
Neurologic Deficit

Adjunct Era

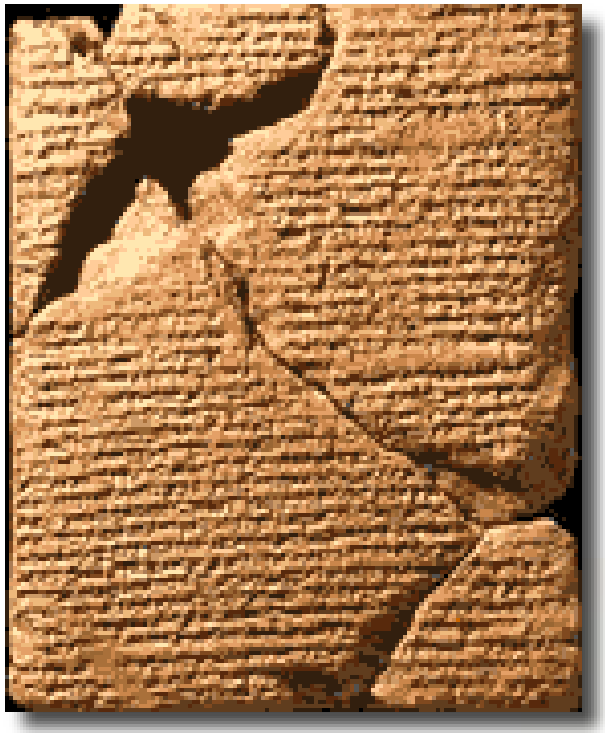


Conclusions

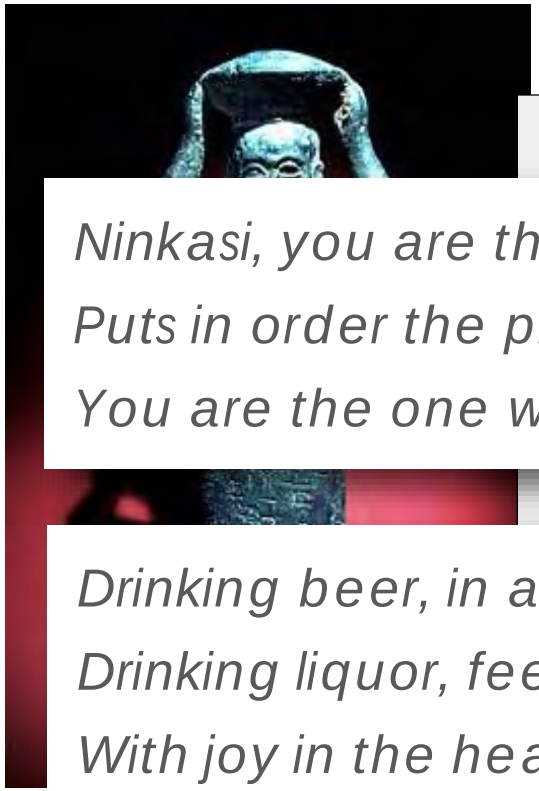
- Despite increased aortic cross-clamp times, adjunct has reduced overall risk of neurologic deficit
- Adjunct use has blunted effect of aortic cross-clamp time
- Adjunct may allow surgeon to operate without pressure of time




HITTITE EMPIRE
(HATTI)
LAKE VAN
ARARAT
(URARTU)
CASPIAN
SEA
HURRIANS
ANATOLIA
LAKE URMIA
SUBARTU
Haran
MITANNI
Nineveh
PADDAN-ARAM
Ashur
Ebla
Ugarit
CYPRUS
SYRIA
(ARAM)
MESOPOTAMIA
AKKAD
Mari
Tigris River
THE GREAT SEA
(MEDITERRANEAN SEA)
Euphrates River
Damascus
CANAAN
Babylon
Jerusalem
ELAM
GOSHEN
NEGEV
Ur
Memphis
SINAI
ARABIA
EGYPT
Nile River
LOWER SEA
(PERSIAN GULF)
RED SEA



Ninkasi: **“You who fill my mouth so full”**



A Hymn to Ninkasi

Ninkasi, you are the one who bakes the bappir in the big oven,
Puts in order the piles of hulled grain.
You are the one who waters the malt set on the ground

Ninkasi, you are the one who handles dough [and]...with a big shovel,
Mixing, in a pit, the bappir with [date]-honey.

The am-am jar, which carries the beer of the lam-sá-re vat...
The beautiful vessels, are ready on [their] pot stands!

Drinking beer, in a blissful mood,
Drinking liquor, feeling exhilarated,
With joy in the heart [and] a happy liver--
While my heart full of joy,
[And] [my] happy liver I cover with a garment fit for a queen!

The fermenting vat, which makes a pleasant sound,
You place appropriately on [top of] a large collector vat.
Ninkasi, the fermenting vat, which makes a pleasant sound,
You place appropriately on [top of] a large collector vat.

The heart of the queen of heaven is happy again!


NINKASI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Texas Medical Center


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VASCULAR SURGERY
Lumbar Drains & Thoracic
Aortic Repair
Lumbar Drains &
Memorial Hermann Heart and
Cardiovascular
Maintaining the Lumbar
Nurse Call
Closet
UT Physicians
OGC SOLID


DELL