

Medical Issues in Peri-operative Care II

Pre-operative Testing

Jeffrey P Schaefer, MD

Rockyview Hospital

April 29, 2003

Objectives

- Evidence Based Approach
 - CBC
 - electrolyte panel
 - liver enzymes
 - coagulation
 - ECG
 - chest radiograph
- Recommendations from the literature
- Can we pre-order pre-op tests?

Pre-operative Assessment Process

- patient is booked for surgery by surgeon
 - appointment to Pre-admission Clinic (PAC)
 - evaluated / educated by PAC nursing staff
 - referral to internist and/or anaesthetist
 - investigations ordered by:
 - surgeon
 - anaesthetist
 - internist
 - investigations completed at PAC visit
 - results screened and abnormalities flagged

Currently at RGH...

- Individual approach to testing among internists...
 - Good Concordance: CBC, M6, ECG
 - Variations: Liver, Coagulation, Radiology
- Surgeon Panels:
 - some order nothing (clinic to determine)
 - some order large panels

DOCTOR	CBC	PT/PTT	M6	M8	U/A	ECG
[REDACTED]	X		X	X		X
[REDACTED]	X	hips/knees	X	X	X	>45
[REDACTED]	X	hips/knees	X		X	>60
[REDACTED]	X		X		X	>50
[REDACTED]	X		X		X	>50
[REDACTED]	X	hips/knees	X		X	>45
[REDACTED]	X		X		X	>40
[REDACTED]	X		X		X	>45
[REDACTED]	X	hips/knees	X		X	>45
[REDACTED]	X	hips/knees	X	X >50	X	>65
[REDACTED]	X		X		X	>50
[REDACTED]	X		X			>45

T. SCHAEFER

names
have been
changed
to protect
the
innocent

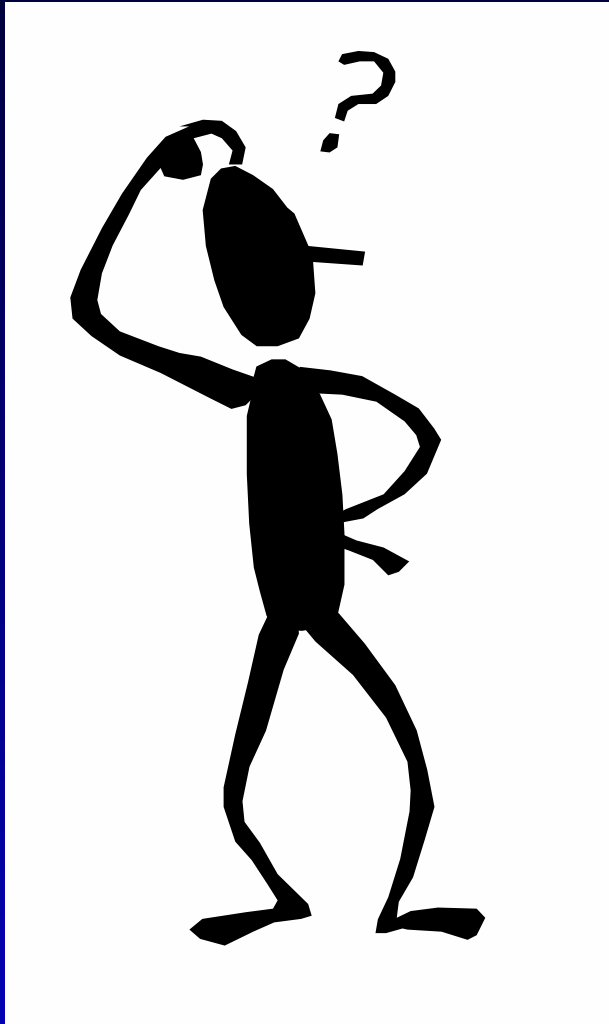
!R >60 (if can not dose in 6 months req on all charts)

+ anyone with cardiac hx

FROM 403 943 3314 TO Jeffrey P Schaefer 23/04/2003 1:34 PM Page 4

04/23/2003 13:33 403-943-3314 RGH PREOP ASSESSMENT PAGE 04/05

J Schaefer - reflections...



- pre-op testing not covered during training
- literature is generally poor
- what are the risks?
 - of not ordering tests
 - of ordering tests
- who actually orders the tests?
- when to test?
 - results from community

Pre-operative Testing in General...

Pre-op Testing UCSF

- U California SF (JAMA 1985)
 - 8,600 elective surgical patients / year
 - all get lab tests according to surgical service
 - sampled ~1,000 patients (2,785 tests)

Pre-op Testing UCSF

- Of 2,785 tests, 60% were not indicated
- Of the 60% not indicated tests, 0.22% MIGHT have influenced perioperative management but for none of these results did there appear to be an intervention taken
- e.g. unexpected hyperglycemia, elevated BUN, nucleated RBC's, WBC of 18

Table 2.—Indication for Preoperative Tests

Test	Indications
Prothrombin time/partial thromboplastin time	Known coagulation disorder, anticoagulant therapy, hemorrhage, anemia, liver disease, malabsorption, malnutrition, or other potentially relevant diseases (eg, systemic lupus erythematosus)
Platelet count	Known platelet abnormality, hemorrhage, purpura, hypersplenism, hematologic malignancy (eg, leukemia), radiation/chemotherapy, thrombosis, some anemias (eg, aplastic), other potentially relevant diseases (eg, systemic lupus erythematosus, paroxysmal nocturnal hemoglobinuria, or renal transplant rejection)
Hemoglobin	Potentially bloody operation (determined by need for preoperative crossmatch), chronic renal failure, known anemia, bleeding disorder, hemorrhage, hematologic malignancy, radiation/chemotherapy, or other potentially relevant diseases (eg, some infections, liver disease, or malnutrition)
White blood cell count and differential cell count	Infection, diseases of white blood cells, including leukemia, radiation/chemotherapy, immunosuppressive therapy, hypersplenism, aplastic anemia, or other potentially relevant abnormalities (eg, rheumatoid arthritis)
Six-factor automated multiple analysis	Age 60 yr or over, diuretic usage, renal disease, other fluid/electrolyte abnormalities (eg, diarrhea, syndrome of inappropriate secretion of antidiuretic hormone, diabetes insipidus, or severe liver disease), or other potentially relevant abnormalities (eg, convulsions)
Glucose level	Diabetes mellitus, hypoglycemia, steroid treatment, pancreatic disease (eg, pancreatitis, carcinoma, or glucagonoma), pituitary disease (eg, acromegaly) hypothalamic disease, or adrenal disease

Pre-op Testing London, Ontario

- UWO - 1987 Arch Int Medicine
- 2,570 pre-op cholecystectomy patients
- of which 1,010 were free of other disease

Test	No. of Tests per 1010 Patients	No. of Abnormal Test Results	No. of Patients With Relevant Complications		Abnormal Test Results		No. of Patients With Abnormal Test Results and Relevant Complications	
			Normal Test Result	Abnormal Test Result	Action	No Action	Action	No Action
White blood cells	1005	1	110	0	0	1	...	...
Hemoglobin	1005	7	14	2	2	5	1	1
Platelets	1005	0	37	...	...	...	...	...
Sodium	995	5	1	0	0	5	...	...
Potassium	995	14	20	1	4	10	1	0
Creatinine	995	2	0	0	0	2	...	...
Urea	995	1	0	0	0	1	...	...
Random serum glucose	396	7	47	1	0	7	0	1
Fasting serum glucose	40	1	7	0	0	1	...	...
Prothrombin time	213	0	14	...	...	...	...	...
Partial thromboplastin time	210	3	13	0	0	3	...	...
Urinalysis								
Glucose	995	0	3	...	...	...	...	...
White blood cells	995	43	42	6	1	42	1	5
Chest roentgenogram	691	38	44	8	8	30	3	5
Electrocardiogram	632	101	8	4	0	101	0	4
Pulmonary function tests	3	3	...	2	2	1	1	1
Blood gases (pH, Po ₂ , Pco ₂)	31	0	3	...	...	...	...	...

*Ellipses indicate not applicable; Po₂, oxygen pressure; and Pco₂, carbon dioxide pressure.

Test	No. of Tests per 1010 Patients	No. of Abnormal Test Results	No. of Patients With Relevant Complications		Abnormal Test Results		No. of Patients With Abnormal Test Results and Relevant Complications	
			Normal Test Result	Abnormal Test Result	Action	No Action	Action	No Action
			White blood cells	1005	1	110	0	0	1	...	...
Hemoglobin	1005	7	14	2	2	5	1	1
Platelets	1005	0	37	...	...	...	...	...
Sodium	995	5	1	0	0	5	...	...
Potassium	995	14	20	1	4	10	1	0
Creatinine	995	2	0	0	0	2	...	...
Urea	995	1	0	0	0	1	...	...
Random serum glucose	396	7	47	1	0	7	0	1
Fasting serum glucose	40	1	7	0	0	1	...	...
Prothrombin time	213	0	14	...	...	...	...	...
Partial thromboplastin time	210	3	13	0	0	3	...	...
Urinalysis								
Glucose	995	0	3	...	...	...	...	...
White blood cells	995	43	42	6	1	42	1	5
Chest roentgenogram	691	38	44	8	8	30	3	5
Electrocardiogram	632	101	8	4	0	101	0	4
Pulmonary function tests	3	3	...	2	2	1	1	1
Blood gases (pH, Po ₂ , Pco ₂)	31	0	3	...	...	...	...	...

*Ellipses indicate not applicable; Po₂, oxygen pressure; and Pco₂, carbon dioxide pressure.

Test	No. of Tests per 1010 Patients	No. of Abnormal Test Results	No. of Patients With Relevant Complications		Abnormal Test Results		No. of Patients With Abnormal Test Results and Relevant Complications	
			Normal Test Result	Abnormal Test Result	Action	No Action	Action	No Action
White blood cells	1005	1	110	0	0	1	...	...
Hemoglobin	1005	7	14	2	2	5	1	1
Platelets	1005	0	37	...	...	...	...	...
Sodium	995	5	1	0	0	5	...	...
Potassium	995	14	20	1	4	10	1	0
Creatinine	995	2	0	0	0	2	...	...
Urea	995	1	0	0	0	1	...	...
Random serum glucose	396	7	47	1	0	7	0	1
Fasting serum glucose	40	1	7	0	0	1	...	...
Prothrombin time	213	0	14	...	...	...	...	...
Partial thromboplastin time	210	3	13	0	0	3	...	...
Urinalysis								
Glucose	995	0	3	...	...	...	...	...
White blood cells	995	43	42	6	1	42	1	5
Chest roentgenogram	691	38	44	8	8	30	3	5
Electrocardiogram	632	101	8	4	0	101	0	4
Pulmonary function tests	3	3	...	2	2	1	1	1
Blood gases (pH, Po ₂ , Pco ₂)	31	0	3	...	...	...	...	...

*Ellipses indicate not applicable; Po₂, oxygen pressure; and Pco₂, carbon dioxide pressure.

Test	No. of Tests per 1010 Patients	No. of Abnormal Test Results	No. of Patients With Relevant Complications		Abnormal Test Results		No. of Patients With Abnormal Test Results and Relevant Complications	
			Normal Test Result	Abnormal Test Result	Action	No Action	Action	No Action
			White blood cells	1005	1	110	0	0	1	...	...
Hemoglobin	1005	7	14	2	2	5	1	1
Platelets	1005	0	37	...	...	...	...	...
Sodium	995	5	1	0	0	5	...	...
Potassium	995	14	20	1	4	10	1	0
Creatinine	995	2	0	0	0	2	...	...
Urea	995	1	0	0	0	1	...	...
Random serum glucose	396	7	47	1	0	7	0	1
Fasting serum glucose	40	1	7	0	0	1	...	...
Prothrombin time	213	0	14	...	...	...	...	...
Partial thromboplastin time	210	3	13	0	0	3	...	...
Urinalysis								
Glucose	995	0	3	...	...	...	...	...
White blood cells	995	43	42	6	1	42	1	5
Chest roentgenogram	691	38	44	8	8	30	3	5
Electrocardiogram	632	101	8	4	0	101	0	4
Pulmonary function tests	3	3	...	2	2	1	1	1
Blood gases (pH, Po ₂ , Pco ₂)	31	0	3	...	...	...	...	...

*Ellipses indicate not applicable; Po₂, oxygen pressure; and Pco₂, carbon dioxide pressure.

Test	No. of Tests per 1010 Patients	No. of Abnormal Test Results	No. of Patients With Relevant Complications		Abnormal Test Results		No. of Patients With Abnormal Test Results and Relevant Complications	
			Normal Test Result	Abnormal Test Result	Action	No Action	Action	No Action
White blood cells	1005	1	110	0	0	1	...	...
Hemoglobin	1005	7	14	2	2	5	1	1
Platelets	1005	0	37	...	...	...	...	...
Sodium	995	5	1	0	0	5	...	...
Potassium	995	14	20	1	4	10	1	0
Creatinine	995	2	0	0	0	2	...	...
Urea	995	1	0	0	0	1	...	...
Random serum glucose	396	7	47	1	0	7	0	1
Fasting serum glucose	40	1	7	0	0	1	...	...
Prothrombin time	213	0	14	...	...	...	...	...
Partial thromboplastin time	210	3	13	0	0	3	...	...
Urinalysis								
Glucose	995	0	3	...	...	...	...	...
White blood cells	995	43	42	6	1	42	1	5
Chest roentgenogram	691	38	44	8	8	30	3	5
Electrocardiogram	632	101	8	4	0	101	0	4
Pulmonary function tests	3	3	...	2	2	1	1	1
Blood gases (pH, Po ₂ , Pco ₂)	31	0	3	...	...	...	...	...

*Ellipses indicate not applicable; Po₂, oxygen pressure; and Pco₂, carbon dioxide pressure.

Test	No. of Tests per 1010 Patients	No. of Abnormal Test Results	No. of Patients With Relevant Complications		Abnormal Test Results		No. of Patients With Abnormal Test Results and Relevant Complications	
			Normal Test Result	Abnormal Test Result	Action	No Action	Action	No Action
White blood cells	1005	1	110	0	0	1	...	...
Hemoglobin	1005	7	14	2	2	5	1	1
Platelets	1005	0	37	...	...	...	...	...
Sodium	995	5	1	0	0	5	...	...
Potassium	995	14	20	1	4	10	1	0
Creatinine	995	2	0	0	0	2	...	...
Urea	995	1	0	0	0	1	...	...
Random serum glucose	396	7	47	1	0	7	0	1
Fasting serum glucose	40	1	7	0	0	1	...	...
Prothrombin time	213	0	14	...	...	...	...	...
Partial thromboplastin time	210	3	13	0	0	3	...	...
Urinalysis								
Glucose	995	0	3	...	...	...	...	...
White blood cells	995	43	42	6	1	42	1	5
Chest roentgenogram	691	38	44	8	8	30	3	5
Electrocardiogram	632	101	8	4	0	101	0	4
Pulmonary function tests	3	3	...	2	2	1	1	1
Blood gases (pH, Po ₂ , Pco ₂)	31	0	3	...	...	...	...	...

*Ellipses indicate not applicable; Po₂, oxygen pressure; and Pco₂, carbon dioxide pressure.

C\$104,000 (1984)

	No. of Patients	No. of Abnormal Test Results	No. of Patients With Relevant Complications		Abnormal Test Results		No. of Patients With Abnormal Test Results and Relevant Complications	
			Normal Test Result	Abnormal Test Result	Action	No Action	Action	No Action
White blood cells	1005	1	110	0	0	1	...	...
Hemoglobin	1005	7	14	2	2	5	1	1
Platelets	1005	0	37	...	...	...	...	...
Sodium	995	5	1	0	0	5	...	...
Potassium	995	14	20	1	4	10	1	0
Creatinine	995	2	0	0	0	2	...	...
Urea	995	1	0	0	0	1	...	...
Random serum glucose	396	7	47	1	0	7	0	1
Fasting serum glucose	40	1	7	0	0	1	...	...
Prothrombin time	213	0	14	...	...	...	...	...
Partial thromboplastin time	210	3	13	0	0	3	...	...
Urinalysis								
Glucose	995	0	3	...	...	...	...	...
White blood cells	995	43	42	6	1	42	1	5
Chest roentgenogram	691	38	44	8	8	30	3	5
Electrocardiogram	632	101	8	4	0	101	0	4
Pulmonary function tests	3	3	...	2	2	1	1	1
Blood gases (pH, Po ₂ , Pco ₂)	31	0	3	...	...	...	...	...

*Ellipses indicate not applicable; Po₂, oxygen pressure; and Pco₂, carbon dioxide pressure.

Pre-op Testing London, Ontario


Table 3.—Summary of Clinical Responses to Abnormal Test Results

Response, No.	Relevant Complications, No. (%)
Action, 17	7 (41.2)
No Action, 209	17 (8.1)
Total, 226	24 (11.0)

Pre-op Testing London, Ontario

Table 3.—Summary of Clinical Responses to Abnormal Test Results

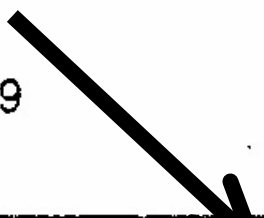
Response, No.	Relevant Complications, No. (%)
Action, 17	7 (41.2)
No Action, 209	17 (8.1)
Total, 226	24 (11.0)



Pre-op Testing London, Ontario

Table 3.—Summary of Clinical Responses to Abnormal Test Results

Response, No.	Relevant Complications, No. (%)
Action, 17	7 (41.2)
No Action, 209	17 (8.1)
Total, 226	24 (11.0)



**Of 10 cases of
Action+ No Complication
Clinical Exam predicted for
the complication in 6.**

Pre-op Testing Rochester, MN

- Mayo Clinic - 1991
- 3,782 ASA class 1 patients
- abnormal lab values 160 patients
- predicted per hx / pe 30 patients
- further work-up 47 patients
- delayed surgery 0 patients
- complications no association

Pre-op Testing Rochester, MN

- Outcome
 - no longer perform lab assessments in healthy patients under age 40 years

Pre-op Testing Rochester, MN

- Mayo Clinic - 1997
- searched database of 56,119 patients
- 5,190 patients no tests in 90 days pre-op
- 1,044 randomly selected for review

Table 1.—Characteristics of 1,044 Mayo Patients Who Underwent Anesthesia and a Surgical Procedure With No Preoperative Laboratory Assessment

Characteristic	Patients	
	No.	%
Gender		
Female	458	44
Male	586	56
Age (yr)*		
≤17	447	43
18-34	355	34
35-49	167	16
50-64	33	3
≥65	42	4
Smoking status		
Never	888	85
Former (>2 mo)	42	4
Current	114	11
ASA physical status†		
I	707	68
II	304	29
III	33	3
Preoperative conditions		
Central nervous system disorder	56	5.4
Asthma	35	3.4
Hypertension	31	3.0
Cancer‡	23	2.2
Cardiac disease§	19	1.8
Arteriosclerosis obliterans	2	0.2
Stroke	1	0.1
Peripheral vascular disease	1	0.1
Chronic obstructive pulmonary disease	1	0.1
Diabetes	1	0.1
Renal disease	0	0.0
Biliary disease	0	0.0

Factor	Patients	
	No.	%
Scheduled as outpatient procedure		
Yes	824	79
No	220	21
Type of anesthesia*		
General	717	69
Regional	144	14
Combined regional and general	43	4
Monitored anesthesia care	140	13
Endotracheal tube	670	64
Primary type of procedure		
Orthopedic	366	35
Ear, nose, and throat	260	25
General surgical	107	10
Ophthalmologic	100	10
Dental	59	6
Urologic	54	5
Gynecologic	51	5
Miscellaneous	47	5

*Duration of anesthesia (min): median, 105; mean \pm standard deviation, 119 ± 74 ; range, 10-560.

Test	Tests performed (no.)			Case†	Age (yr)	Result
	Total	Normal results	Abnormal results			
<i>Intraoperative</i>						
Arterial blood gases	2	1	1	1	3	Po ₂ = 216; Pco ₂ = 30; pH 7.4; HCO ₃ ⁻ = 19
Hemoglobin	7	6	1	2	48	8 g/dL
Electrolytes	4	4	0	...	...	...
Electrocardiography	1	0	1	3	19	RBBB
Other (2 ACTs, Chemstrip, blood type and screen)	4	4	0	...	...	...
<i>Postoperative</i>						
Arterial blood gases	2	1	1	4	1 day	See text
Hemoglobin	22	19	3	...	16	9.6 g/dL
				...	18	9.9 g/dL
				...	24	9.2 g/dL
Electrolytes	17	16	1	4	1 day	Na ⁺ = 127
Electrocardiography	2	1	1	5	30	PVCs
Prothrombin time	1	1	0	...	...	...
Total	62	53	9	...	...	...

*ACTs = activated clotting times; HCO₃⁻ = bicarbonate (mEq/L); Na⁺ = serum sodium (mEq/L); Pco₂ = partial pressure of carbon dioxide (mm Hg); Po₂ = partial pressure of oxygen (mm Hg); PVCs = premature ventricular contractions; RBBB = right bundle branch block on electrocardiography.

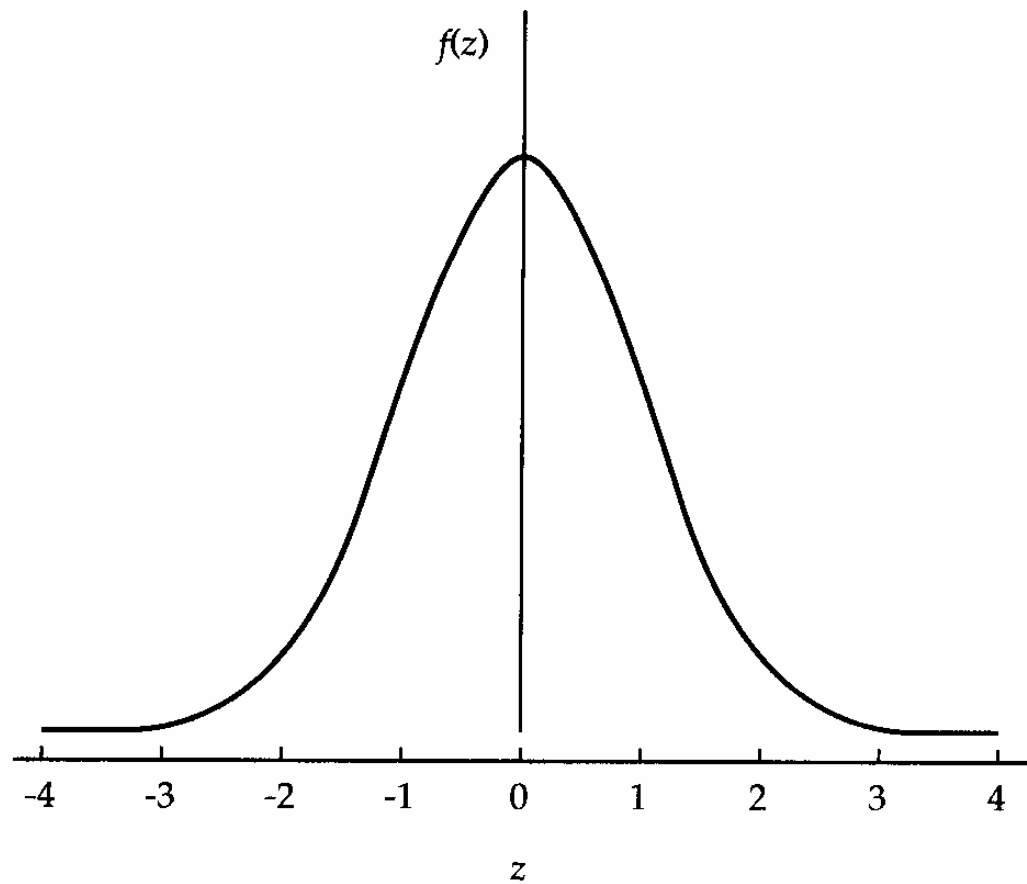
†See text for case reports.

Pre-op Testing Rochester, MN

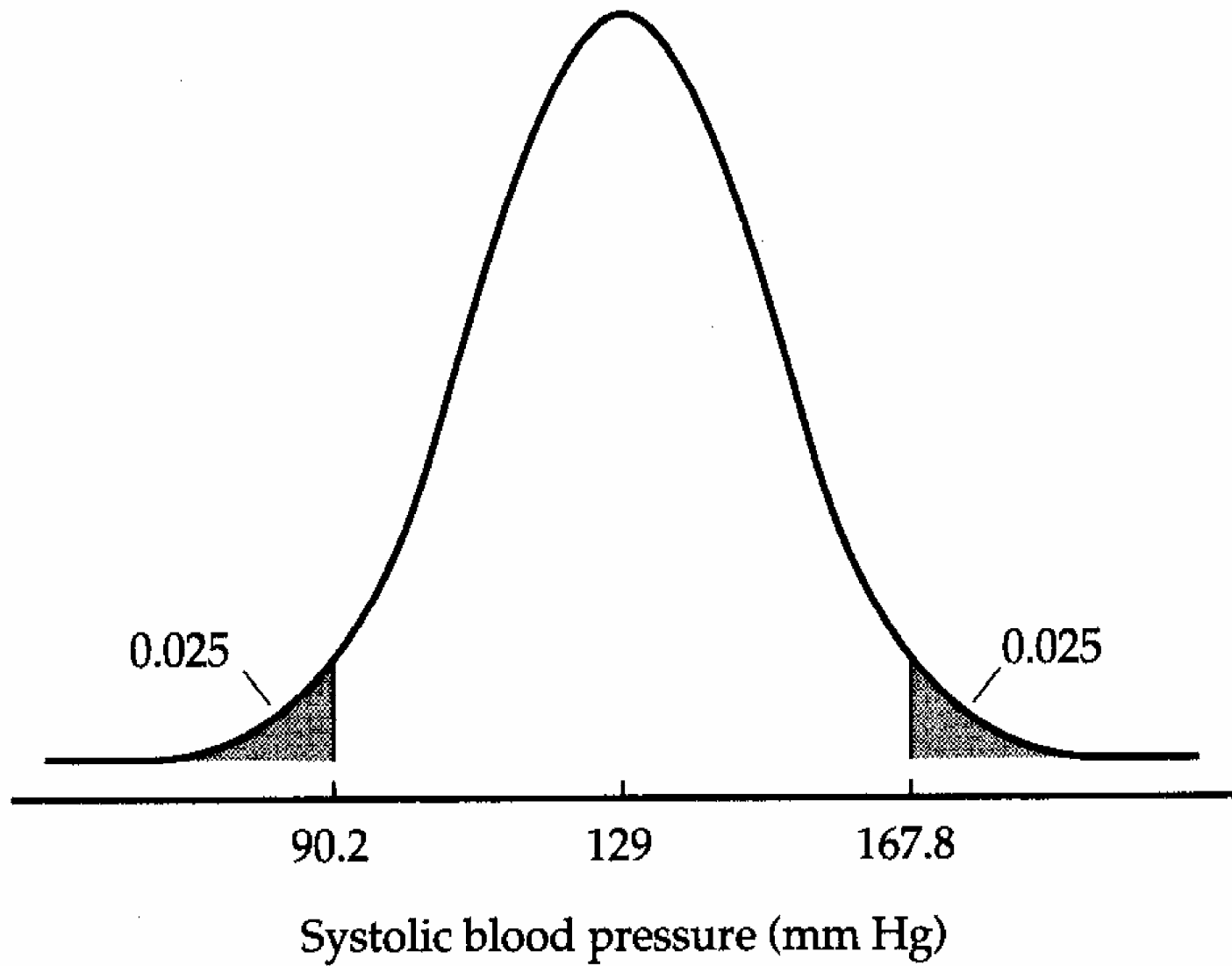
- In no cases was there a complication that would not have been expected on the basis of history, physical exam, and observations at surgery.

Statistical Issues

- Reference (normal) ranges for laboratory results is based on the notion of a Gaussian Distribution.



The standard normal curve for which $\mu = 0$ and $\sigma = 1$



Selective versus Routine testing

Probability of an Abnormal Screening Test Result

Number of independent tests	Probability of abnormal test
1	5 percent
2	10 percent
4	19 percent
6	26 percent
10	40 percent
20	64 percent
50	92 percent

Selective vs Routine Testing

Predictive Value of Positive Test Results

Prevalence of disease, percent	Predictive value of positive test, percent
0.1	1.9
1.0	16.1
2.0	27.9
5.0	50.0
50.0	95.0

What we learned so far...

- Tests are probably being ordered in the absence of an indication.
- High frequency of false positive tests.
- Low yield associated with tests without indication.
- Low probability of intervention among abnormal tests.
- Healthy young patients appear to be safe without pre-operative testing in one study.

Hemogram

- Hemoglobin
 - anemia is present in 1% of asymptomatic patients
- UCSF
 - 1 / 610 of non indicated hemoglobins = 41 g/l
 - it was a lab error, repeat was normal

Anemia and Peri-op Mortality NJ

- Brown University (Lancet 1996)
- 1,958 patients undergoing surgery (in OR)
- all refused transfusion for religious reasons
- primary outcome = 30 day mortality

30 day mortality post-op by [Hgb]

Preoperative haemoglobin (g/dL)	Total number (n=1958)	Dead (n=63)	% dead (exact 95% CI)
<6.0	36	12	33.3 (18.6–51.0)
6.0–6.9	27	5	18.5 (6.3–38.1)
7.0–7.9	49	6	12.2 (4.6–24.7)
8.0–8.9	39	5	12.8 (4.3–27.4)
9.0–9.9	75	6	8.0 (3.0–16.6)
10.0–10.9	109	5	4.6 (1.5–10.4)
11.0–11.9	212	5	2.4 (0.8–5.4)
≥12.0	1411	18	1.3 (0.8–2.0)

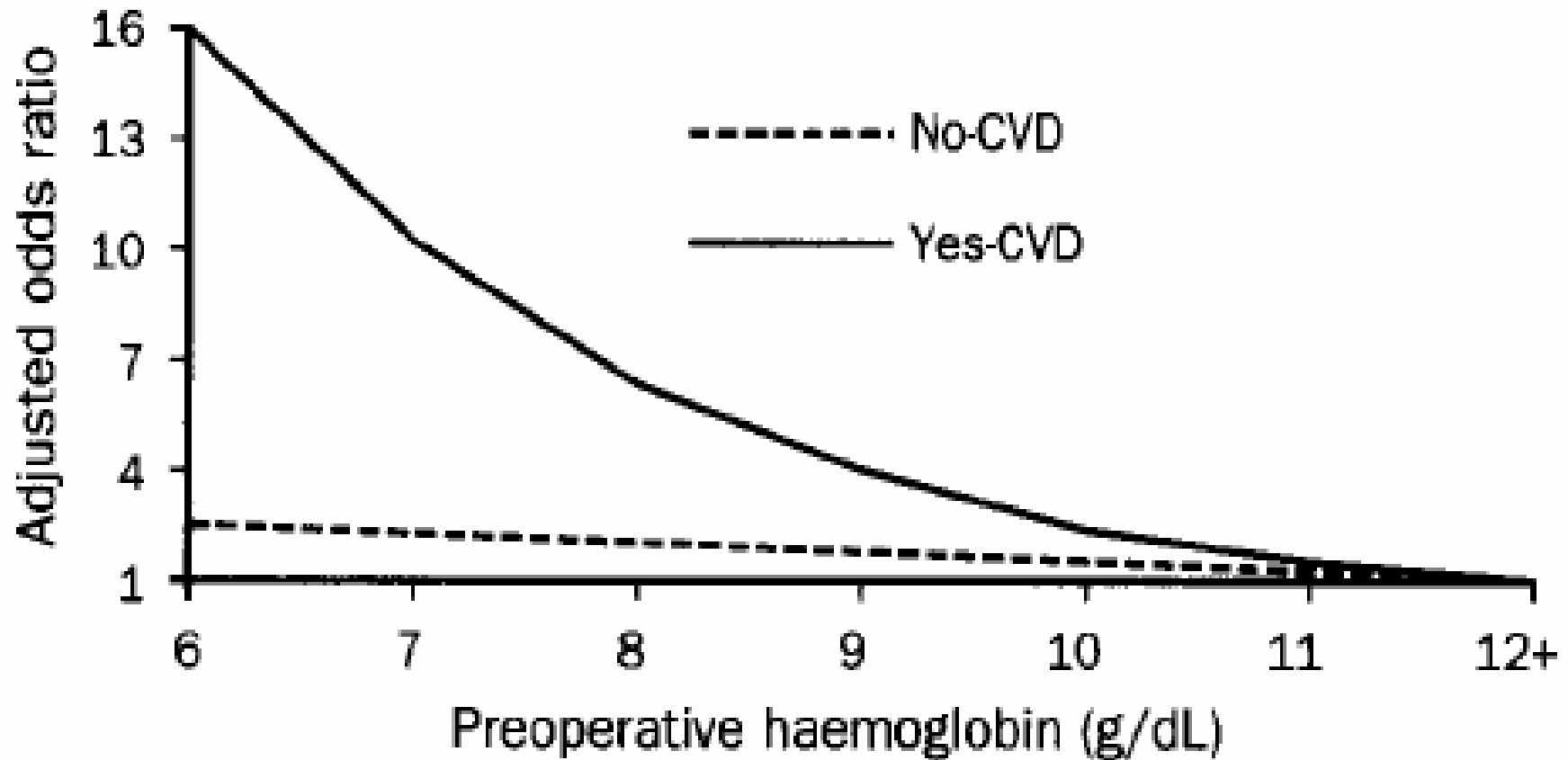


Figure: Adjusted odds ratio for mortality by cardiovascular disease and preoperative haemoglobin

- CVD = hx of angina, chf, or atherosclerosis

Outcome	Number (%)*	Dead	% dead (95% CI)
Any serious morbidity	123 (6.3)	38	30.9 (22.9–39.9)
Cardiac outcome	91 (4.7)	36	39.6 (29.5–50.4)
Myocardial infarction	8 (0.4)	2	25.0 (7.1–59.1)
Congestive heart failure	41 (2.1)	11	26.8 (14.2–42.9)
Arrhythmia	30 (1.5)	15	50.0 (31.3–68.7)
Conduction defect	2 (0.1)	2	100 (100–100)
Infection outcome	52 (2.7)	11	21.2 (11.1–34.7)
Bacteraemia	12 (0.6)	4	33.3 (9.9–65.1)
Pneumonia	32 (1.6)	7	21.9 (9.3–40.0)
Deep wound infection	15 (0.8)	2	13.3 (1.7–40.4)
Respiratory failure	45 (2.3)	27	60.0 (44.3–74.3)

*The individual outcomes do not add to 123 because some patients had more than one morbid event.

Variable	Total number (n=1958)	Dead (n=62) ^a	Relative risk (95% CI)
Female	1382 (70.6%)	38 (2.8%)	0.7 (0.4–1.1)
White	1030 (52.6%)	28 (2.7%)	0.7 (0.5–1.2)
Age (years)			
18–59	1334 (68.1%)	19 (1.4%)	1.0 (reference)
60–74	452 (23.1%)	27 (6.0%)	4.2 (2.4–7.5)
≥75	172 (8.8%)	16 (9.3%)	6.5 (3.4–12.5)
Cancer in past 5 years	201 (10.3%)	17 (8.5%)	3.3 (1.9–5.7)
Diabetes mellitus	191 (9.8%)	21 (11.0)	4.7 (2.9–7.9)
History of hypertension	559 (28.6%)	35 (6.3%)	3.2 (2.0–5.8)
Angina pectoris	77 (3.9%)	7 (9.1%)	3.1 (1.5–6.6)
Congestive heart failure	66 (3.4%)	12 (18.2%)	6.9 (3.9–12.3)
Atherosclerosis	186 (9.5%)	17 (9.1%)	3.6 (2.1–6.2)
Cardiovascular disease	221 (11.3%)	22 (10.0%)	4.3 (2.6–7.1)
Cardiopulmonary disease	230 (11.8%)	24 (10.4%)	4.8 (2.9–7.8)
APS + age score			
0–6	1621 (82.8%)	17 (1.0%)	1.0 (reference)
7–14	318 (16.2%)	34 (10.7%)	10.2 (5.8–18.0)
>14	19 (1.0%)	11 (57.9%)	55.2 (30.0–101.5)
Charlson score			
0–1	1631 (83.3%)	22 (1.3%)	1.0 (reference)
2–3	199 (10.2%)	16 (8.0%)	6.0 (3.2–11.2)
>3	128 (6.5%)	24 (18.8%)	13.9 (8.0–24.1)
Intraperitoneal, intrathoracic, or aortic procedure	995 (50.8%)	43 (4.3%)	2.2 (1.3–3.7)
Emergency surgery	140 (7.2%)	16 (11.4%)	4.5 (2.6–7.8)
General anaesthesia	1604 (81.9%)	54 (3.4%)	1.5 (0.7–3.1)

Hemoglobin

- Asymptomatic anemia is rare.
- Death rates among anemic patients depend on degree of anemia and presence of co-existing cardiac disease.

Electrolyte Panel / Creatinine

- UCSF
 - frequency of abnormal electrolyte among those without indication = 1 / 514 (elevated BUN)
 - it was not acted upon
- Indications
 - > 60, diuretics, renal disease, hx of diarrhea, SIADH, diabetes insipidus, severe liver disease, or potentially relevant abnormality (e.g. history of seizure)

Pre-operative Coagulation Testing

- Four major articles assessed PT, PTT +/- BT and platelet count.
- All Agreed
- In the absence of a clinical history of excess bleeding, there was no utility to ordering PT or PTT

Hemostatic Testing - France

- Creteil, France (Am J Surg 1995)
- 3,242 consecutive surgical patients
- all got: Plt, BT, PTT, INR
- all got: questionnaire about bleeding

Questionnaire

- easy bruising?
- bleeding > 3 min after brushing teeth?
- nosebleeds?
- severe or prolonged menstrual periods?
- GI or GU blood loss?
- prolonged bleeding after dental extraction?
- prolonged bleeding after surgery?
- prolonged bleeding after childbirth?
- personal / family history of hemophilia?
- history of renal failure, hypersplenism, blood disease, connective tissue disease?
- history of drugs known to interfere with hemostasis?

Hemostatic Testing - France

Questionnaire

NEG

POS

NEG

A

C

Tests

POS

B

D

Hemostatic Testing - France

- Groups B and D (positive test)
 - more delays
 - except 1 person, group D received specific therapies (*platelets, FFP, vitamin K, Factor IX complex)
- Groups A, B, C, D
 - no difference in hematoma, bruises, volume of blood loss, reoperation for hemorrhage, and mortality due to bleeding or median #PRBCs
- % needing PRBC
 - A(4.6%), B(6.2%), C(clin)(11.3%), D(22%)

Predictive Value of aPTT - Rochester

- Rochester, NY (JAMA 1986)
- retrospective study
- Conclusion: Among those without a clinical history of bleeding an elevated aPTT had a sensitivity to predict post-op hemorrhage of between 7 - 11% and a likelihood ratio of 0.58 - 0.87.
- The aPTT added nothing to clinical criteria.

Bleeding Time

- American Society of Clinical Pathologist's Position Article (Arch Surg 1998)
- “In the absence of a history of excessive bleeding, the bleeding time fails as a screening test and is, therefore, not indicated as a routine preoperative test”

Am Soc Clin Path con't

- Bleeding Times
 - ASA 300 mg od 217 +/- 69 sec
 - ASA 1200 mg od 240 +/- 60 sec
 - placebo 217 +/- 63 sec

“The bleeding time cannot be used to reliably identify patients who may have recently ingested aspirin or NSAIDs or those who have a platelet defect attributable to these drugs”

Liver Enzymes Mayo Clinic Proceedings 1991

- 3,782 consecutive ASA 1 patients
 - All: IM, Ped, or other non-surg MD PAC consult
- 12 / 3,782 (0.3%): AST > 2 x ULN (12-31 U/l)
 - AST range 62 - 360 U/l
 - predicted clinically 4 / 12
 - notation in chart 8 / 12
 - operation delayed 0 / 12
 - new treatment 0 / 12
 - adverse event no association

Urinalysis Texas

- Purported rationale: “detect UTI in order to reduce risk of remote wound infection”
- San Antonio (Arch Int Med 1988)
- Retrospective study of clean knee surgery
- n = 200
- no prostheses or trauma
- > 15 years

Criteria for Preoperative Urinalysis

Medically indicated urinalysis

Urinary tract symptoms*

Elevated levels of serum urea nitrogen or creatinine*

History of renal disease*

Systemic disease that may affect kidneys (eg, diabetes, hypertension, systemic lupus erythematosus or other connective tissue disease, systemic infection)*

Edema or hypoalbuminemia of unclear cause

Fever from sepsis of unclear source

Nephrotoxic drugs

Anticoagulants, coagulopathy

Pregnancy

Unexplained abdominal or back pain

Metabolic acidosis

Volume depletion; hyponatremia or hypernatremia

Abnormal results†

Hematuria, ≥ 2 RBCs/HPF

Pyuria, ≥ 5 WBCs/HPF

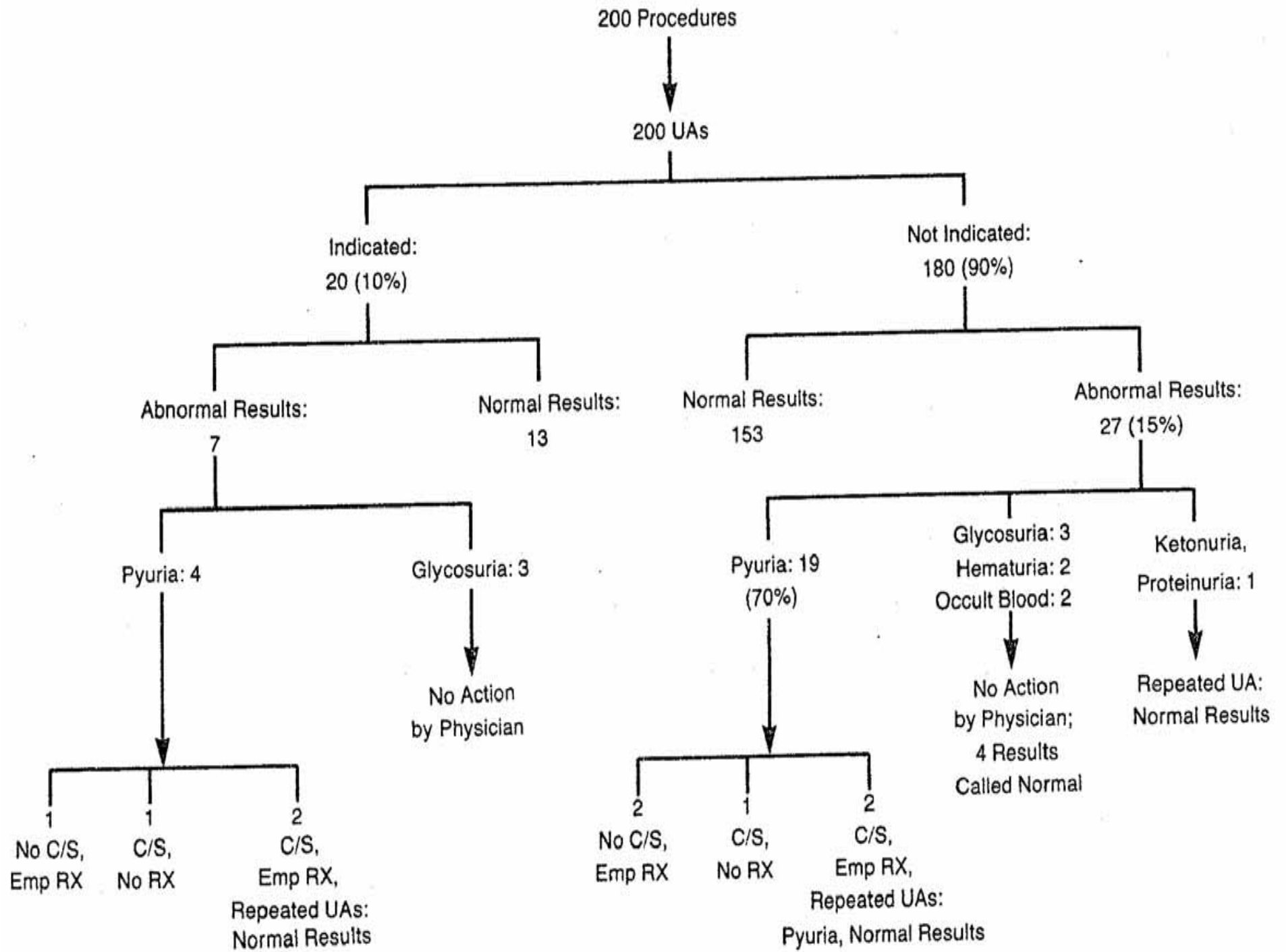
Casts other than hyaline

Proteinuria, >trace

Ketonuria, >small

Glycosuria

Occult blood



Urinalysis Texas

- Positive UA 15%
- MD response rate 29%
- Wound infection 1 / 200 (normal UA)
- Cost analysis study of UA and knee infx:
 - UA prevents 1 knee wound infection at price of US \$1,500,000

Table 4. Frequency of Abnormalities Found on Preoperative Electrocardiogram

Electrocardiogram Abnormality	Frequency of Abnormality (%)
Q waves	33.9
Minor*	7.2
Major*	26.7
Left axis deviation	19.3
Right axis deviation	0.4
ST junction/segment depression	17.9
Minor*	6.9
Major*	11
T wave changes	36.5
Minor*	22.2
Major*	14.3
Left ventricular hypertrophy	6.9
Mobitz type II	0.2
First-degree atrioventricular block	3.0
Short PR interval	0.8
Pacemaker	1.6
Left bundle branch block	4.3
Right bundle branch block	5.3
Interventricular conduction delay	1.0
Frequent premature atrial complexes	7.0
Frequent premature ventricular complexes	4.3
Atrial fibrillation	3.5
Sinus tachycardia (HR >100)	3.9
Sinus bradycardia (HR <50)	0.4
ST segment elevation	8.3

Note: *See Appendix 1 for definitions of major and minor criteria.
HR = heart rate.

Q waves

minor Q 7.2%

major Q 26.7%

all Q 33.9%

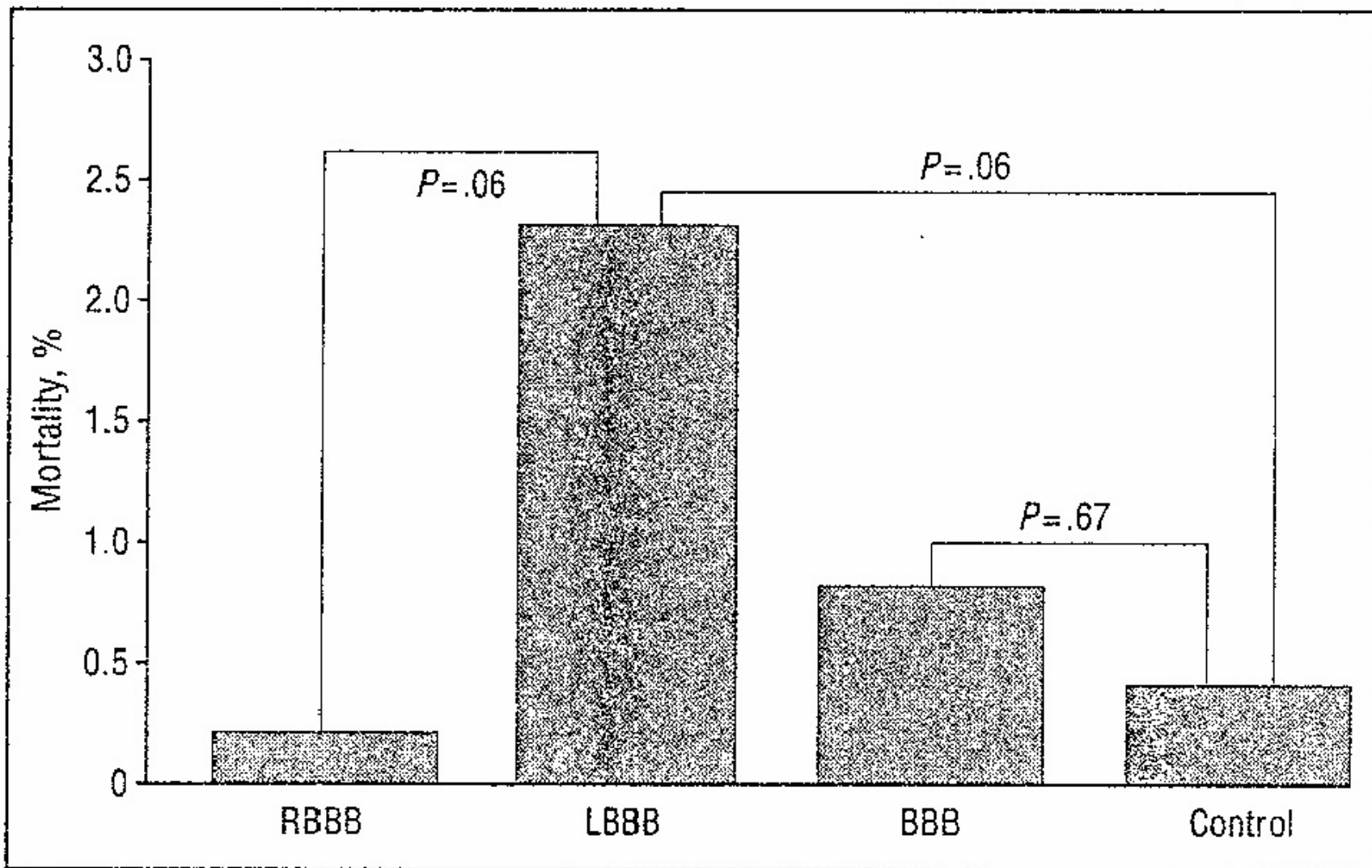
LBBB 4.3%

Table 1. Preoperative Health Conditions of the Study Population

Preoperative Condition	Patients n (%)
Hypertension	300 (58.5)
Diabetes mellitus	78 (15.2)
Smoking history	202 (39.4)
Angina pectoris	85 (16.6)
Myocardial infarction	47 (9.2)
Prior coronary artery bypass graft surgery	31 (6.0)
Prior percutaneous transluminal coronary angioplasty	19 (3.7)
Congestive heart failure	41 (8)
Arrhythmias	100 (19.5)
Valvular disease	27 (5.3)
Pulmonary disease	112 (21.8)
Renal disease	35 (6.8)
Neurologic disease	112 (21.8)
Vascular disease	90 (17.5)
American Society of Anesthesiologists Physical Status classification	
I	9 (1.8)
II	229 (44.6)
III	247 (48.1)
IV	23 (4.5)
V	3 (0.6)
Not recorded	2 (0.4)

Bundle branch block - Baltimore

- Johns Hopkins (Arch Int Med 2000)
- adult surgical patients 25,539
- BBB 525 (2.1%)
 - LBBB 119 (26.2%)
 - RBBB 336 (73.8%)



Mortality in patients with bundle-branch block (BBB group), control group, and subgroups of patients with left (LBBB) and right BBB (RBBB).

Bundle branch block - Baltimore

- No MI, pulmonary edema or ventricular dysrhythmia in any BBB
- Deaths
 - RBBB 1 owing to CVA after AVM reparation
 - LBBB 3 owing to sepsis
- Conclusion: BBB does not predict for CV complications

Chest Radiograph

- UC Irvine (JAMA 1983)

Table 1.—Risk Factors for Abnormal Chest Roentgenogram

Medical History

Cancer at any site

Valvular heart disease

Stroke

Myocardial infarction

Angina

Asthma

Tuberculosis

Chronic obstructive pulmonary disease

Cigarettes

Occupational exposures: asbestos, fumes, or ores

Review of Systems

General: fever, chills, sweats, or weight loss

Paroxysmal nocturnal dyspnea

Orthopnea

Class 3 or 4 dyspnea

Angina

Physical Findings

Vital signs: fever, tachycardia, hypertension, or tachypnea

Chest: abnormal breath sounds; abnormal adventitial sounds, or dullness

Cardiovascular: severe murmurs, S3, or displaced point of maximum impulse

Abdominal: tenderness, organomegaly, or ascites

- Also age > 60 yrs
- Very broad range of items!

Table 2.—Chest Roentgenographic Abnormalities, by Age and Risk Group

Age, yr	Patients With Risk Factors		Patients Without Risk Factors			Total
	Total No.	No. (%) With Serious Abnormalities on Chest Roentgenogram	Total No.	No. (%) With Serious Abnormalities on Chest Roentgenogram	No. With No Chest Roentgenogram	
≤20	52	5 (10)	83	0 (0)	24	159
21-30	101	10 (10)	156	1 (0.6)	6	263
31-40	79	6 (8)	69	0 (0)	3	151
41-50	83	14 (16)	31	0 (0)	0	114
51-60	85	38 (45)	29	0 (0)	0	114
>60	104	41 (40)	0	0 (0)	0	104
Total	504	114 (22)	368	1 (0.3)	33	905

Table 2.—Chest Roentgenographic Abnormalities, by Age and Risk Group

Age, yr	Patients With Risk Factors		Patients Without Risk Factors		
	Total No.	No. (%) With Serious Abnormalities on Chest Roentgenogram	Total No.	No. (%) With Serious Abnormalities on Chest Roentgenogram	No. With No Chest Roentgenogram
≤20	52	5 (10)	83	0 (0)	24
21-30	101	10 (10)	156	1 (0.6)	6
31-40	79	6 (8)	69	0 (0)	3
41-50	83	14 (16)	31	0 (0)	0
51-60	85	38 (45)	29	0 (0)	0
>60	104	41 (40)	0	0 (0)	0
Total	504	114 (22)	368	1 (0.3)	33

Table 2.—Chest Roentgenographic Abnormalities

Age, yr	Patients With Risk Factors		Patients With Risk Factors			Total
	Total No.	No. (%) With Serious Abnormalities on Chest Roentgenogram	Total No.	No. (%) With Serious Abnormalities on Chest Roentgenogram	No. With No Chest Roentgenogram	
≤20	52	5 (10)	83	0 (0)	24	159
21-30	101	10 (10)	156	1 (0.6)	6	263
31-40	79	6 (8)	69	0 (0)	3	151
41-50	83	14 (16)	31	0 (0)	0	114
51-60	85	38 (45)	29	0 (0)	0	114
>60	104	41 (40)	0	0 (0)	0	104
Total	504	114 (22)	368	1 (0.3)	33	905

Elevated left hemidiaphragm - not pursued



Preoperative Patient Questionnaire†

- Do you feel unwell?
- Have you ever had any serious illnesses in the past?
- Do you get any more short of breath on exertion than other people of your age?
- Do you have any coughing?
- Do you have any wheezing?
- Do you have any chest pain on exertion (anginal type)?
- Do you have any ankle swelling?
- Have you taken any medicine or pills in the last three months (including excess alcohol)?
- Have you any allergies?
- Have you had an anesthetic in the last two months?
- Have you or your relatives had any problems with a previous anesthetic?
- Observation of serious abnormality from "end of bed" which might affect anesthetic?
- What is the date of your last menstrual period?

† Adapted from Wilson, ME, Williams, MB, Baskett, PJ, et al, Br Med J 1980; 1:509

So what should be ordered?

- Mayo Clinic (1991)

**Table 3.—Minimal Preoperative Test Requirements
at the Mayo Clinic***

Age (yr)	Tests required
<40	None
40-59	Electrocardiography, measurement of creatinine and glucose
≥60	Complete blood cell count, electrocardiography, chest roentgenography, measurement of creatinine and glucose

*In addition, the following guidelines apply:

A complete blood cell count is indicated in all patients who undergo blood typing and who are screened or cross-matched.

Measurement of potassium is indicated in patients taking diuretics or undergoing bowel preparation.

Chest roentgenography is indicated in patients with a history of cardiac or pulmonary disease or with recent respiratory symptoms.

A history of cigarette smoking in patients older than 40 years of age who are scheduled for an upper abdominal or thoracic surgical procedure is an indication for spirometry (forced vital capacity).

Pre Pre-Op Testing?

- It seems desirable to have all needed investigations completed at PAC.
- Annals Int Med 1990:
 - 13 / 3,096 tests that were previously normal became abnormal of which most were predictable by history (median time 2 month)

Required...

- Mayo type protocol.
- Questionnaire for bleeding.
- Questionnaire for liver disease.
- Questionnaire for chest radiograph risk.
- Have blood and CXR done pre-visit.
- ECG at PAC

American Society of Anesthesiologists Classification of Preoperative Risk[†]

ASA class	Systemic disturbance	Mortality
1	Healthy patient with no disease outside of the surgical process	<0.03 percent
2	Mild to moderate systemic disease caused by the surgical condition or by other pathological processes	0.2 percent
3	Severe disease process which limits activity but is not incapacitating	1.2 percent
4	Severe incapacitating disease process that is a constant threat to life	8 percent
5	Moribund patient not expected to survive 24 hours with or without an operation	34 percent
E	Suffix to indicate emergency surgery for any class	Increased

[†]Adapted from Cohen, MM, Duncan, PG, Tate, RB, JAMA 1988; 260:2859.