

Evaluation and Management of the Polytraumatized Patient in Various Centers

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A questionnaire was sent to the following 6 trauma centers: University Hospital for Accident Surgery, Hannover, Federal Republic of Germany (Prof. H. Tscherne); University of Munich, Department of Surgery, Klinikum Grosshadern, Munich, Federal Republic of Germany (Prof. G. Heberer); Akademiska Sjukhuset Uppsala, Sweden (Prof. S. Olerud); University Hospital, Department of Surgery, Basel, Switzerland (Prof. M. Allgöwer); Hôpital de la Pitié, Paris, France (Prof. R. Roy-Camille); and University of Texas Southwestern Medical School, Dallas, Texas, U.S.A. (Prof. B. Claudi). Their answers have been summarized in a few short paragraphs where tabulation was not possible, and then mainly in tabular form for convenient comparison among the various centers. There seems to be considerable international agreement on the main points of early aggressive cardiopulmonary management to prevent multiple organ failure and also, surprisingly, on the advantages of early internal fixation of major fractures.

How Do You Define Polytrauma?

Hannover: Three severe injuries, at least 1 of which is life-endangering.

Munich: Injury to more than 1 body region, of which at least 2 must reach a grade 1 in SAT-system (see below).

Uppsala: Multiple injuries to soft tissues, bone, and parenchymatous organs combined with shock.

Basel: Extensive injury involving body cavity + 1 major fracture, 2 body cavities, or 3 major fractures.

Paris: Two or more peripheral, visceral, or complex injuries with respiratory and circulatory failure. (This excludes patients who only have sustained fractures.)

Dallas: Multiply injured patient presenting lesions to 2 cavities, associated with 2 or more long bone failures; lesions to 1 cavity associated with 2 or more long bone failures; or lesions to multiple extremities (at minimum, 3 long bone failures).

Do You Grade Polytrauma, and If So, How?

Hannover: Yes, with our own grading system along with ISS and AIS.

Munich: SAT-System (Grosshadern scale)—S₁₋₃ = injuries of skeletal system; A₁₋₃ = abdominal injuries; and T₁₋₃ = thoracic injuries; plus shock index for brain trauma and shock.

Uppsala, Basel, and Paris: No.

Dallas: Grading is done according to Schweiberer's classification. This goes along well with the trauma severity score (Gaber), which is mainly accepted in the U.S.A.

Approximate Number of Polytrauma Patients per Year? (If subgrades available, please indicate)

Hannover: One hundred twenty intensive care with artificial ventilation and 140 multi-injured without artificial ventilation.

Munich: In 1978, there were 57; in 1979, 108; in 1980, 86; in 1981, 119; and by May, 1982, there were 43.

Uppsala: Five to ten per year.

Basel: About 50.

Paris: About 60.

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Dallas: About 250 (all grades)—1st grade about 50–75; 2nd grade about 75–100; and 3rd grade about 75–100.

On What Total Number (Approximate or Precise) of Polytrauma Patients Do You Base Your Statements?

Hannover: Precise number, 860.

Munich: Precise number, 407.

Uppsala: Not given.

Basel: Precise number, 250.

Paris: Precise number, 166 in 3 years (1979–1981).

Dallas: About 250 per year.

Prophylaxis of Pulmonary Failure:

1. What in your opinion is the most important consideration in preventing pulmonary failure?

Hannover: Volume treatment and mechanical ventilation with PEEP.

Munich: Early shock treatment and early intubation with controlled (PEEP) respirator therapy.

Uppsala: Effective shock treatment combined with prophylactic ventilation with PEEP in patients with polytrauma and septic shock.

Basel: Early diagnosis and prevention of cardiopulmonary failure by early use of CPAP or PEEP.

Paris: Avoid pulmonary overload and perform extubation as early as possible.

Dallas: Early mechanical ventilation associated with appropriate shock treatment.

2. What are your criteria to apply CPAP (continuous positive airway pressure) with mask?

Hannover: Not instead of mechanical ventilation; only after extubation.

Munich: Conscious patients after extubation, impaired ventilation.

Uppsala: We do not use CPAP with mask.

Basel: Decreasing P_{O_2} on room air.

Paris: Interstitial pulmonary edema but no other impairment of homeostasis.

Dallas: $P_{O_2} < 80$ mm Hg at FiO_2 0.21.

3. What are your criteria to intubate and ventilate the patient under PEEP (positive end expiratory pressure)?

Hannover: Dependent on severity of injury. Always in lung contusion. No limits in pulmonary function parameters. PEEP is always used.

Munich: Unconscious patients, severe trauma, shock (even transitory), massive transfusion, and thoracic trauma.

Uppsala: (a) We use prophylactic ventilation

with PEEP in our polytrauma patients (see earlier definition of polytrauma patient). (b) severe sepsis with shock; (c) primary pulmonary trauma; (d) severe brain damage; or (e) derangements in blood gases in *septic* or *trauma* patients.

Basel: Deterioration despite CPAP.

Paris: Surgical intervention with general anesthesia. Clinical signs of respiratory insufficiency with radiological proof of pulmonary edema.

Dallas: $P_{O_2} < 60$ mm Hg at FiO_2 0.21.

4. Do you use indwelling peridural anesthesia in serial rib fractures?

All 6 centers use it.

Your Criteria for Diagnosing a Generalized Sepsis?

Hannover and Munich: Not stated.

Uppsala: History: previous trauma, major surgery, burns, etc., complicated with fever, chills, and often (but not required) a positive blood culture combined with a low systemic blood pressure.

Basel: Hyperfibrinogenemia, thrombocytopenia, glucose intolerance (increased insulin requirement), positive blood cultures.

Paris: Positive blood culture, fever together with general symptoms of chills, hemodynamic and biological (leucocytosis) modifications.

Dallas: Continuing fever $> 38.5^\circ\text{C}$, fibrinogen split products, increasing glucose intolerance, increasing O_2 consumption, positive blood culture.

In What Way Does A Compound Fracture Alter Your Choice of Treatment in Multiple Injury Patients?

Hannover: Delayed wound closure.

Munich: Fracture *must* be stabilized within the first 6 hours.

Uppsala: More rigid fixation system and more open wound treatment.

Basel: Indication for stabilization more stringent.

Paris: A complex fracture *must* be treated within the first 24 hours, but an eventual neurosurgical or abdominal intervention has priority. Frequently an orthopedic operation is performed consecutively, under the same anesthesia.

Dallas: Insist on emergency stabilization (the day of admission).

Nutritional Support

1. In patients with abdominal trauma and sepsis: How?

Hannover: Provide 3,000 cal/day, as soon as possible feeding by gastric tube.

Munich: Parenteral, more fat than sugar, 3,000 cal.

Uppsala: Total parenteral nutrition using carbohydrates, amino acids, and fat combined as soon as possible with tube (enteral) feeding.

Basel: Total parenteral nutrition.

Paris: Exclusively parenteral (3,000 cal/day).

Dallas: Parenteral support 4,000–6,000 cal/day on average, consisting of a glucose-fructose-amino acids-essential fatty acids balance.

2. In patients with brain injury and long-lasting unconsciousness: How?

Hannover: Same way.

Munich: Mainly by gastric tube (as early as possible) 3,000–3,500 cal.

Uppsala: Tube feeding (enteral).

Basel: Total parenteral nutrition followed by nasogastric tube feeding.

Paris: Enteral nutrition (drip feeding by gastric tube and nutrition by pump).

Dallas: Initial parenteral support, followed by gastrointestinal tube feeding with 5,000–7,000 cal/day on average.

If You Have Graded Your Patients, How Does Lethality Relate to the Grading?

Hannover: Bad correlation with AIS and ISS.

Munich: Fractures: no influence. Brain trauma alone (50%) and thoracic trauma followed by PTPI and multiple organ failure are the main causes of death.

Uppsala, Basel, and Paris: No grading.

Dallas: For 1°, 5%; 2°, 10%; 3°, 35%.

What Have Been the Major Factors, in Your Opinion, that Have Brought about Improvement of Prognosis in Polytrauma Patients during the Last 20 Years?

Hannover: Better intensive care, PEEP ventilation, and aggressive volume replacement. Early osteosynthesis of major fractures.

Munich: The fact that polytrauma is seen as a compound syndrome, not only a sum of several injuries. Better rescue (helicopter), improved anesthesia techniques (respirator), and improved training of surgeons.

Uppsala: Early use of aggressive shock treatment, careful respiratory monitoring, and early use of ventilator with PEEP (prophylactic ventilation).

Basel: Progress in prevention of infection and of acute respiratory failure. Progress in monitoring and control of cerebral edema.

Paris: During the period 1960–1970, improvement of emergency treatment and of rescue systems for more rapid admission to hospital were significant. Since 1970, progress is mainly due to the improved knowledge of the physiology of the lungs in the polytraumatized patient.

Dallas: Improved rescue systems, appropriate aggressive shock treatment, early mechanical ventilation, team approach observing the goals of an overall treatment plan, early operative fracture care, improved consistent medical treatment in ICU, early nutritional support, and improved diagnostic procedures, e.g., computed tomography scans.

Résumé

Un questionnaire a été envoyé à six centres traumatologiques. Leurs réponses ont été résumées en brefs paragraphes ou disposées en tableaux pour permettre une comparaison entre les différents centres.

Il apparaît de cette étude d'un accord général s'est fait sur la nécessité d'adapter un traitement actif en regard du système cardiopulmonaire pour prévenir la défaillance des différents systèmes organiques et—à notre surprise—sur les avantages que présentent la fixation intérieure des fractures importantes.

Table 1. Responses to additional questions by 6 trauma centers.

	Clinic (author)					
	Hannover (Tscherne)	Munich (Heberer)	Uppsala (Olerud)	Basel (Wolff/Dürig)	Paris (Roy-Camille)	Dallas (Claudi)
Main general evaluation criteria:						
Time related changes in pulse rate:						
Very helpful				X	X	
Helpful		X	X			X
Of little help	X					
Time related changes in blood pressure:						
Very helpful				X	X	X
Helpful		X	X			
Of little help	X					
"Shock index" (PR/BP) studied?						
Yes	X	X		X		X
No			X		X	
If studied:						
Very helpful			-	X	-	
Helpful		X				X
Of little help	X					
Hourly urinary output:						
Very helpful	X	X	X	X		X
Helpful					X	
Of little help						
Blood gases:						
Very helpful	X	X	X	X		X
Helpful					X	
Of little help						
CVP:						
Very helpful		X	X	X		
Helpful	X				X	X
Of little help						
PAP:						
Often	X		X	X	X	
Exceptionally		X				X
Never						
Wedge pressure:						
Often	X		X	X	X	
Exceptionally		X				X
Never						
Pulmonary failure (approx. frequency)						
Early pulmonary failure, "fat embolism syndrome" without evidence of sepsis:						
Often					X	
In a significant minority						X
Very rarely		X	X	X		
Never	X					
Pulmonary failure connected with sepsis, due to wound infection:						
Often			X			
In a significant minority				X		
Very rarely	X	X			X	X
Never						
Pulmonary failure connected with abdominal complications and abscesses:						
Often			X	X	X	
In a significant minority						X
Very rarely	X	X				
Never						

Table 1. Continued

	Clinic (author)					
	Hannover (Tscherne)	Munich (Heberer)	Uppsala (Olerud)	Basel (Wolff/Dürig)	Paris (Roy-Camille)	Dallas (Claudi)
Late pulmonary failure due to pneumonia:						
Often		X			X	X
In a significant minority			X	X		
Very rarely	X					
Never						
Severe brain injuries rapidly followed by "incurable pneumonia" despite cardiopulmonary prophylaxis and treatment:						
Yes				X		
No	X	X	X		X	X
Septic complications						
Cases with prolonged febrile course:						
Often	X				X	X
In a significant minority		X	X	X		
Very rarely						
Never						
Does the bacteriological contamination of tracheal aspirates influence your choice of antibiotics?						
Yes	X	X	X	X		X
No					X	
Infection rate (%) in clean surgical wounds in multiple injury patient:						
Estimate	2%	3%	-		5%	10%
Precise data				X		
Infection rate of compound fractures (%) in multiple injury patient:						
Treated by internal fixation						
Estimate	4.5%	3%			5%	~10%
Precise data				70%		
Treated by external fixation						
Estimate	4.5%	27%		?	18%	~6%
Precise data						
Treated by plaster						
Estimate	1-2%	-	-		<2%	~10%
Precise data				0		
Use of internal fixation in closed fractures of major bones in multiple injury patients						
Timing for proximal long bones:						
Femur						
First 24 hours	X	X	X	X	X	
First week						X
Later						
Humerus						
First 24 hours	-	X		X	X	
First week			X			X
Later						
Timing of distal long bones:						
Tibia						
First 24 hours		X	X	X	X	
First week	X					X
Later						

Table 1. Continued

	Clinic (author)					
	Hannover (Tscherne)	Munich (Heberer)	Uppsala (Olerud)	Basel (Wolff/Dürig)	Paris (Roy-Camille)	Dallas (Claudi)
Forearm						
First 24 hours		X	X		X	
First week	X			X		X
Later						
Timing in acetabular fractures:						
First 24 hours						
First week	X	X	X	X	X	X
Later						
Use of external fixator:	-					
Exclusively		^a				
Occasionally			X	X	X	X
Use of internal fixation:						
Exclusively	X	^b		X	X	
Occasionally			X			X
Timing in complete disruption of sacro-iliac joint:						
First 24 hours			X			
First week	X			X	X	X
Later		X				
External fixator:	-					
Exclusively						
Occasionally			X	X	X	X
Internal fixation:						
Exclusively	X	X			X	X
Occasionally			X	X		
Traction:			-			
Exclusively						
Occasionally	X			X	X	X
Timing in fractures of the vertebra:						
Cervical spine:		^c				
First 24 hours	X		X	X	X	
First week						X
Later						
Thoracic spine:		-				
First 24 hours	X		X	X	X	
First week						X
Later						
Lumbar spine:		-				
First 24 hours	X		X	X	X	
First week						X
Later						
Results in terms of survival						
To what time period are these data related?	-	1978- 5/15/82	1970- 1980	1974-1978	1979-1981	1/10/80- 4/30/82
Lethality:						
Estimate			~20%			30-35%
Precise data	11.6% (81)	17.5%		16%	35%	
Prognosis improved since 1960?						
Yes	X	X	X	X	X	X
No						
Prognosis improved since 1970?						
Yes	X	X	X	X	X	X
No						

^aDepends on type of fracture and state of soft tissues.

^bIn closed fractures and compound fractures, 1st degree and some 2nd degree.

^cNo operative treatment in our clinic.