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Original Research Paper

Orthopaedics

OBSERVATIONAL DESCRIPTIVE STUDY OF FAT EMBOLISM SYNDROME IN LONG BONE & PELVIC FRACTURE CASES

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ABSTRACT Background: Fat embolism syndrome (FES) is a constellation of symptoms and signs subsequent to long bones and pelvic fracture cases after trauma.

Materials and Methods: The clinical profile of FES in the study population was studied Between january2017 and may 2018, 1116 cases of long bone and pelvic fractures screened out of which 25patients (23male and 2 female) meet the criterion of Schonfeld and Gurd for diagnosis of fat embolism syndrome

Results: The incidence of FES among all patients with long bone and pelvic fractures was 2.24%. The diagnosis of FES was made by clinical and laboratory findings using Gurd's criteria and Schonfeld criteria. The mean injury severity score was 10.72 (SD 1.69) (range 10-19). Hypoxia was the commonest presentation (88%). Average time of onset after trauma was 49hr.In 76% patients consciousness was impaired (GCS score below 13).Mortality of 8% was observed.Management include primarily oxygen support, adequate hydration and delay of surgery until symptoms resolves over average 8.6days.

Conclusion: Fat embolism remains a diagnosis of exclusion and is a clinical dilemma. Clinically apparent FES needs high index of suspicion, especially in long bone and pelvic fractures.

KEYWORDS : Fat embolism, Gurd's criteria and Schonfeld criteria.

I.INTRODUCTION

Fat embolism is the presence of fat globules in the peripheral circulation and lung parenchyma most often after a long bone fracture or major trauma. FES is a serious consequence of this phenomenon producing a distinct pattern of clinical symptoms and signs generally involving the skin and the lungs and the brain as described by Gurd⁽¹⁾. Clinical onset of symptoms may occur within 12 hrs; but usually patients manifest symptoms 24-72 hrs later. Presentation is variable and no individual symptom is diagnostic of the syndrome. The criterion for diagnosis of FES remains controversial. Some would accept only histological demonstration of fat macroglobules in the organs, while others define the syndrome by clinical abnormalities. Many of the clinical abnormalities are subtle, and must be diligently sought in patients with high suspicion by careful prospective monitoring. Classically patients present with respiratory, neurological and cutaneous manifestations as described by Gurd.[1] Over the years various authors have adapted the Gurd's criteria with slight changes. An Observational descriptive study of fat embolism syndrome in long bone & pelvic fracture cases done at Department of Orthopaedics, SMS Medical College, Jaipur (Rajasthan) India

II. MATERIALS AND METHODS

This Observational descriptive study done at Department of Orthopaedics, SMS Medical College, Jaipur (Rajasthan) India, during january2017 and may 2018, 1116 cases of long bone and pelvic fractures screened out of which 25patients (23male and 2 female) meet the criterion of Schonfeld and Gurd for diagnosis of fat embolism syndrome. We approached the patients of long bone and pelvic fracture first received in emergency department, after initial workup for admission patients who were stable shifted to general ward and routine investigations to be performed in ward, as here being a tertiary care institute mostly patients load is more and surgery is generally done approx 2-3 days after admission. Meanwhile in this period some patients complain of difficulty in breathing, rashes and altered consciousness to time place person. These patients were given special attention and all vital parameters and oxygen saturation by pulse oximetry noted and these patients were more likely to be of fat embolism syndrome shifted to ICU for close monitoring and for further workup as per Gurd's criteria and Schonfeld's criteria

To meet the clinical diagnosis of FES, patients needed to demonstrate at least 1 major and 3 minor or 2 major and 2 minor signs. Data collected included demographics, injury severity scores (ISS), clinical presentation, time of onset of symptoms of FES, laboratory investigations, management and outcomes. Comparison between various diagnostic criteria was studied.

III. RESULTS

There were 1116 patents with long bone and pelvic fracture, admitted during the study period, out of which 25patients (23male and 2 female) meet the criterion for diagnosis of fat embolism syndrome. Road traffic accident was most common mode of injury presenting in 92%(23) cases, and other mode of injuries were Assault and Fall from height, representing 4%(1) Each. Most commonly associated fracture pattern 64%(16) with FES is type B, (AO32B as per AO classification)72%(18) patient were below 30 year age. Youngest patient was of age 22 years and Eldest patient was of age 42 year. Mean age of the patients was 28.6 years. 92%(23) patients were Male and 8%(2) patients were female.) Earliest onset was at 22 hrs and Late onset was at 72 hrs after injury, median onset of symptoms after injury was 49hrs. In 88%(22) Patients onset of

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symptoms of FES were between 24 to 72 hrs.



In 76% (19)patients we found impaired consciousness (GCS sore below 13). In 88% (22)Patients SpO_2 % was below 80%, Minimum saturation was 52% and maximum saturation was 90%, Mean SpO_2 (%) was 69.88. ABG analysis showed mean $PaO_255.56$ (mmHg), mean $PaCO_231.96$ (mmHg), mean HCO_324.93 (meq/L), mean pH was 7.4

92% (23) patients were Thrombocytopenic, Minimum platelet count was of 0.64 (Lakh/Cumm) and Maximum was 1.8 (Lakh/Cumm), while mean platelet count was 1.04 (Lakh/Cumm). (Level below 1.5 Lakh/Cumm is thrombocytopenia).

76% (19) of Cases were anemic (Hb below 10gm/dL) at the time of diagnosis. Minimum level was of 6.7gm/dL and maximum was 11.5gm/dL, with a Mean Hb 9.22gm/dL. 68%(17) Patients were Hypocalcemic (Normal range 8.9-10.1mg/dL). 8%(2) patients required ventilator Support for continuous fall of saturation and respiratory distress. But both of these patients did not survive. Earliest patient was operated on day 2 of injury, this patient developed FES post operatively, while rest of all patients were operated after they recovered from FES. Mean day of operation is 8.61,Earliest day of discharge was 9th Day while longest stay was of 15 days,Mean hospital stay was of 11.86 days

IV. DISCUSSION

FES is most common after skeletal injury and it is most likely to occur in patients with multiple long bone(mostly with femur) and pelvic fractures. As there is no specific test to diagnose the entity, so it is very challenging task for clinician, or truly said its diagnostic dilemma. Fat embolises in almost every patient of long bone fracture or major tissue trauma. Gurd's criteria were proposed in 1974 and since then there is no 'universal criteria' or 'gold standard' for the diagnosis of FES.The incidence of post-traumatic FES has been reported to be as low as 0.2-0.9% in retrospective studies to as high as 35% in prospective studies [Table 1].^[12,24] Clinically apparent FES in our study population was 2.24%. There were no pediatric patients diagnosed with FES in our study.

Table 1: Incidence and mortality of fat embolism syndrome in various studies

Year	Study design	Incidence %(n)	Mortality %(n)	Study reference
1983	Prospective- Randomized trial of steroids in 62 trauma patients	15% (9)	None	Schonfeld ^[12]
1984	Prospective- 80 consecutive trauma patients	8.75% (7)	2.5%(2)	Chan ^[16]
1987	Prospective- trial of steroids in 55 trauma patients	13%	none	Lindeque
1990	Prospective- 96 consecutive long bone fractures over 12 months	11% (10)	10% (1)	Fabian ^[17]
1993	Retrospective- 25 years review	0.26% (20)	20% (4)	Robert ^[18]
1997	Retrospective- 10 years review of trauma cases	0.9% (27)	7%(2)	Bulger ^[2]

Major signs

Patients with FES present with a classic triad of respiratory manifestations (88%), cerebral effects (76%) and petechiae (16%).^[2,6] 8% (2) of the patients with FES caused by long bone fractures developed severe hypoxemia and respiratory insufficiency and

required mechanical ventilation.^[7] Majority of our patients (88%) had respiratory distress and hypoxic presentation. Other differential diagnoses of hypoxia were excluded. Bulger et al noted acute hypoxia in 96% patients of FES.^[2] Neurological signs due to cerebral emboli occur in up to 86% of cases and often occur after the development of respiratory distress.^[8] The more common clinical presentation as in our cases (76%) was acute confusional state,GCS below 13. None of our patients with neurological deterioration had any residual neurodeficit. Petechial rash is considered pathognomonic of FES and reportedly present in only 16% of patients, usually on the conjunctiva, oral mucous membranes and skin folds of the neck and axillae.^[9] Despite cutaneous changes being a major criterion of the Gurd's criteria, only four of our patients were reported to have petechial rash with an incidence of 16%. This probably could be attributed to the difficulty and delay in identifying rash in the darker skin of the Asian population, its presence for a short duration of time.

Schonfeld gave the maximum score to petechiae which was, however, seen in only four of our patients.

Minor signs and laboratory tests

Recovery of fat globules in blood and identification of fat droplets within cells recovered by bronchoalveolar lavage (BAL) has been suggested as a rapid and specific method for establishing the diagnosis of the FES, although of uncertain significance.^[12,13]

Our patients were not tested for fat globules in sputum or BAL. Anemia and thrombocytopenia unexplained by any other cause were observed in 75%,92% of our patients respectively. The cause for hypocalcemia is not well-understood but may result from affinity of plasma free fatty acids (FFA) for calcium or elevated serum lipase.^[8,14] Hypoalbuminemia (present 84% patients) has also been suggested due to FFA binding to albumin.^[15]

Table 2: Gurd's criteria^[1]

Major	1.	Petechial rash
criteria	2.	Respiratory symptom with radiographic change
	3.	Central nervous system sign unrelated to trauma or
		other conditions
Minor	1.	Tachycardia (HR 120>bpm)
criteria	2.	Pyrexia (temperature>39°C)
	3.	Retinal change (fat or petechiae)
	4.	Acutethrombocytopenia
	5.	Acute decrease in hemoglobin
	6.	High erythrocyte sedimentation rate (ESR), more than
		71mm/First hr
	7.	Fat globules in sputum

Table 3: Schonfeld's criteria^[11]

Criteria	Point
Petechiea	5
Chest X-ray change (diffuse alveolar change)	4
Hypoxemia (PaO ₂ <9.3kPa)	3
Fever (temperature>38°C)	1
Tachycardia (HR>120bpm)	1
Tachypnea (RR>30/min)	1
Confusion	1

(total score > 5 required for diagnosis Of FES Syndrome) (2 major criteria or 1 major criterion

plus 2 minor

. criteria Required to diagnose FES Syndrome)

V.CONCLUSION

FES remains a clinical challenge and is diagnosis of exclusion based only on clinical ground because of absence of any specific laboratory test .A high index of clinical suspicion is required for diagnosis and initiating prompt supportive management in patients with FES following fracture of long bone and pelvis, especially in patients undergoing intramedullary reamed nailing. The mean age was 28.6 years. It is due to higher incidence in young men as they are more prone to high velocity road traffic accidents. 92% patients were Male and 8% patients were female, as male are more commonly involved in RTAs. In 88% Patients onset of symptoms of FES were between 24 to 72 hrs. On laboratory findings thrombocytopenia, anemia, hypoxemia, fat globules in urine aided in early identification of patients is mandatory as the mortality is high as 8% in our study at SMS hospital and medical college Jaipur. Management primarily remains supportive: modern ICU care, ventilator support and efficient nursing care. Clinical expertise with high degree of suspicion in susceptible trauma population enables diagnosis and appropriate management of this relatively rare but significant syndrome.

CONFLICT OF INTERSET

None declared till now.

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