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Urine for fat globulin levels in long bone fractures

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Abstract
Introduction: With the increasing incidence of trauma worldwide there has been an increase in the incidence of fractures involving the long bones globally as compared to the past (1, 2). There are a variety of associated injuries that occur along with the complex fractures in cases of trauma.
Materials and Methods: The study was conducted after institutional research board clearance and after approval from the human ethics committee. All patients fulfilling the inclusion and exclusion criteria admitted at A.J.I.M.S. will be considered for the study after obtaining informed written consent. Once the patient was fit for surgery patient were operated by senior staff. Preoperatively the urine was sent for detection of fat globulin and Postoperatively the urine was sent for detection of fat globulin evaluation within 3 hours of surgery. The collected data was analysed by SPSS 17.0 version software.
Observations and Results: Males were 88% p =0.008, left side 52% p =0.078. 33% were admitted within 4-5 Among all bones tibia was the commonest of the bone fracture involved 67 cases, combination of tibia and fibula was the commonest seen in 44.00%.The examination of urine for fat globulin post operatively was negative in all 100 of the cases. The examination of urine for fat globulin pre operatively was positive in 2% of the cases.
Conclusion: 1 The present study we found that urine fat globulins in fractures involving the long bone are present in two percent of cases. In both cases the patients had sustained multiple bone fractures. There was a delay in presentation to the hospital of more than 4 hours in both cases. Both patients had an elevated BMI fat in urine in fractures involving the long bone have no correlation to complications.

Keywords: Fat globulin, long bone fractures

Introduction
With the increasing incidence of trauma world-wide there has been an increase in the incidence of fractures involving the long bones globally as compared to the past [1, 2].
There are a variety of associated injuries that occur along with the complex fractures in cases of trauma The most common associated injuries are the soft tissues injuries that most often tend to be widespread [3]. The complications linked with the treatment of these traumatic injuries consist of infection, blood loss, fat embolism, fracture union abnormalities, joint stiffness, prolonged immobilization [4]. Among all these complications that are related to fractures the most dangerous one is the fat embolism [5]. The syndrome of fat embolism and its association with fractures involving the long bone was well demonstrated in the early eighteen century but this one is the least researched topic among the orthopedicians [6]. Fat emboli can potentially happen in every one of the patient who has fractures involving the long bone; but barely a small number of patients develop symptomatic systemic dysfunction, especially the classical dysfunction triad of fat embolism involving the skin, brain, and lung recognized as the fat embolism syndrome (FES) [7]. There are various research literatures that have demonstrated beyond doubt that the incidence of the fat embolism syndrome ranges between 1-29 percent [9-12].
The fat embolism syndrome (FES) is a uncommon medical state in which the fat emboli or fat macro globules that circulate cause multisystem dysfunction [13, 15]. Eriksson *et al* in their study stated that in cases of trauma in approximately 82% cases the fat emboli can be demonstrated.
Various factors add to the incidence of FES. Mechanical and biochemical theories are postulated for the pathophysiology of FES. The clinical features include respiratory and cerebral dysfunction along with a petechial rash. Diagnosis of FES is tricky as all the other cause have to be excluded [15, 16].

The clinical criterion; along with imaging modalities aid in coming to a diagnosis. It can be detected in the early hours by continuous pulse oximetry monitoring of the high-risk patients. Treatment of FES is fundamentally supportive [9-14].
Fat globules in urine are one of the easily detected pathology which can be easily done by any laboratory, and is considered as one of the early makers of FES [15-18].
In a country like India where there are lack of medical facilities, there exists a need to identify high risks patients early with simple, low cost investigations so that they can be easily referred to higher centres where the facility for adequate supportive medical care is available. There is a paucity of literature regarding the FES from the Indian subcontinent especially from south India. In the smart city of Mangalore road traffic accidents are very common.
The medical college where this study is planned is on the national highway and caters to a number of trauma patients. In view of all the above said we at a in a tertiary care medical hospital in south India decided to study the incidence of FES by evaluating the urine fat as an indicator in a study titled as "URINE FOR FAT GLOBULIN LEVELS IN FRACTURES INVOLVING THE LONG BONE".

Materials and methods source of data
All patients of either sex admitted at A.J.I.M.S. Hospital, who met a predefined the inclusion and exclusion criteria as cited below.

a) **Study Design:** Prospective study design
b) **Study Period:** August 2017 to August 2019.
c) **Place of Study:** A.J.I.M.S. Hospital, Mangalore.
d) **Sample Size:** About 100 patients.
e) **Sampling Technique:** Simple random sampling will be adopted to select the patients who meet the inclusion criteria for the study.
f) Sampling Criteria:

(a) Inclusion Criteria
- Sex: Both sexes.
- Closed Long bone shaft fractures –tibia, femur
- Within 8 hrs of trauma
- Within 3 hrs of post op

(b) Exclusion Criteria
- Age less than 18 and more than 70.
- Infection at the operative site
- With renal comorbidities
- With open fractures involving the long bone
  Medically unfit for surgery.
- Not willing for surgery.
- Not willing to give written consent for inclusion in the study group.

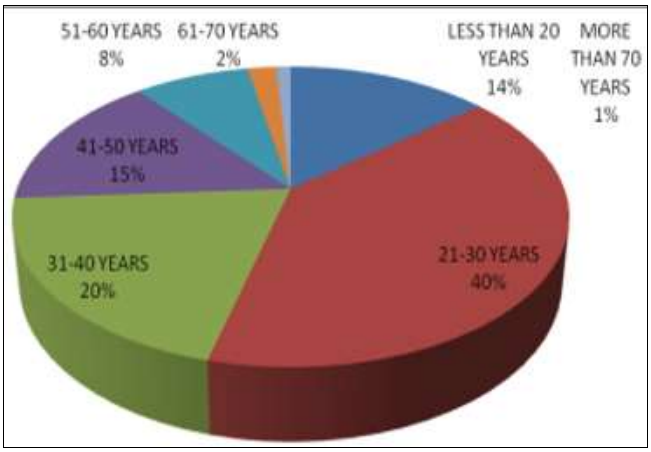
Method of collection of data
1 Methodology
The study was conducted after institutional research board clearance and after approval from the human ethics committee. All patients fulfilling the inclusion and exclusion criteria admitted at A.J.I.M.S. will be considered for the study after obtaining informed written consent.
The patients • demographics, • socio-economic status, • history, • clinical findings, • diagnosis, • summary of investigations and • interventions were recorded in the study Performa. Once the patient was fit for surgery patient were operated by senior staff. • Postoperatively the urine was sent for detection of fat globulin evaluation with in 3 hrs of surgery

Data and statistical analysis
The collected data was analyzed by during expiration17.0 version software the categorical variables were expressed as mean and percentage and the continuous variables were expressed with confidence interval, mean and SD The strength of association between the variables was tested by chi square/fishers exact test. Paired t-test and a p value that was less than 0.05 was taken as statistically significant 1 • P

Observations and Results

Table 1: Age

AGE GROUP	NUMBER	PERCENTAGE
LESS THAN 20 YEARS	14	14.00%
21-30 YEARS	40	40.00%
31-40 YEARS	20	20.00%
41-50 YEARS	15	15.00%
51-60 YEARS	8	8.00%
61-70 YEARS	2	2.00%
MORE THAN 70 YEARS	1	1.00%
TOTAL	100	100.00%

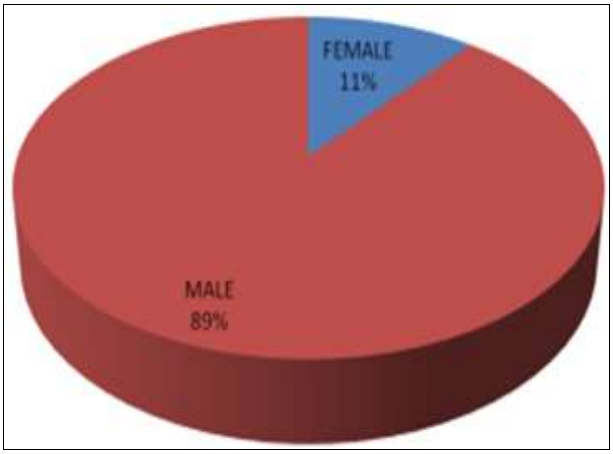


The most common age group was 21-30 years 40% of the study population p=0.0065

Graph 1: Age

Table 2: Sex

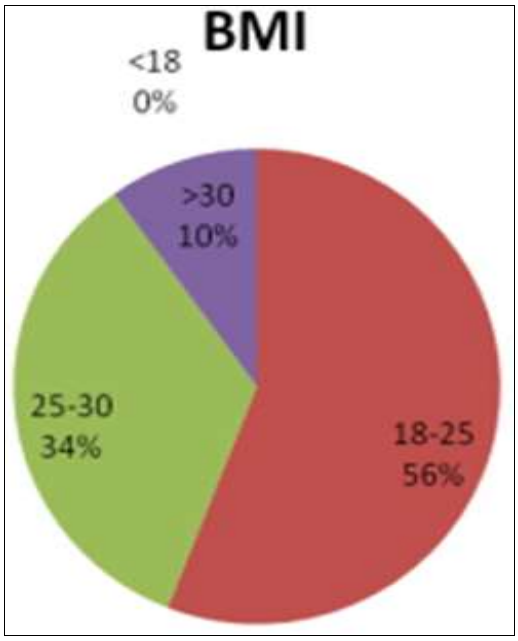
SEX	NUMBER	PERCENTAGE
FEMALE	11	11.00%
MALE	89	89.00%
TOTAL	100	100.00%



Graph 2: Sex

Table 3: BMI

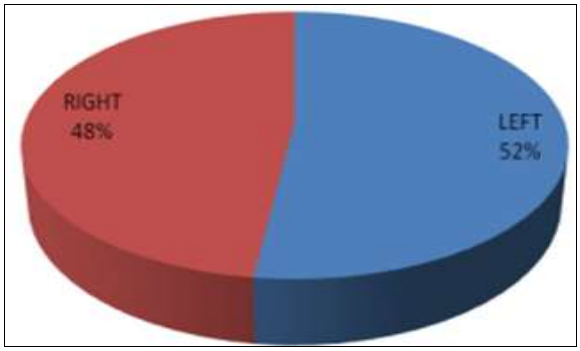
BMI KG/M2	NUMBER	PERCENTAGE
<18	0	0.00%
18-25	56	56.00%
25-30	34	34.00%
>30	10	10.00%
TOTAL	100	100.00%



Graph 3: BMI

Table 4: Side of injury

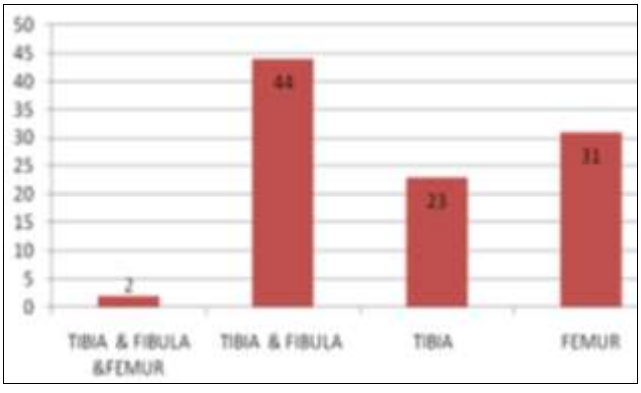
TABLE NUMBER 4: SIDE OF INJURY		
SIDE OF INJURY	NUMBER	PERCENTAGE
LEFT	52	52.00%
RIGHT	48	48.00%
TOTAL	100	100.00%



Graph 4: Side of injury

Table 5: Site of injury

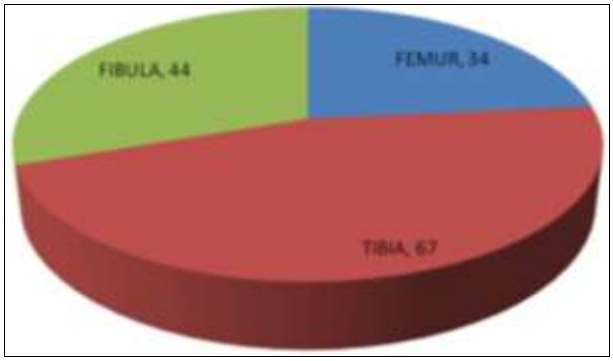
SITE	NUMBER	PERCENTAGE
TIBIA & FIBULA &FEMUR	2	2.00%
TIBIA & FIBULA	44	44.00%
TIBIA	23	23.00%
FEMUR	31	31.00%
TOTAL	100	100.00%



Graph 5: Site of injury

Table 6: Type of bone fracture

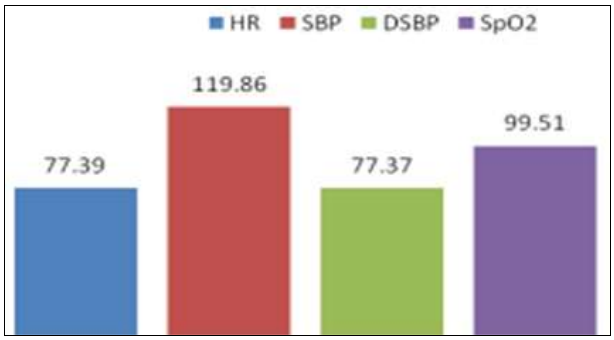
TYPE OF BONE FRACTURE	NUMBER	PERCENTAGE
FEMUR	34	23.45%
TIBIA	67	46.21%
FIBULA	44	30.34%
TOTAL	145	100.00%



Graph 6: Type of bone fracture

Table 7: Hemodynamic parameters on admission

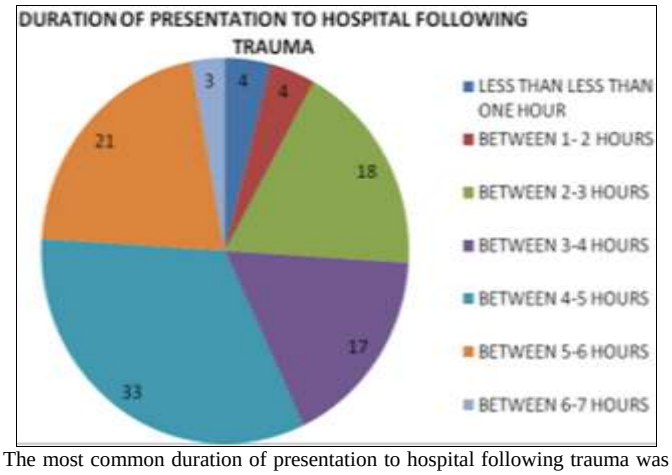
HEMODYNAMIC PARAMETERS ON ADMISSSION	HR	SBP	DSBP	SpO2
MEAN	77.38	119.85	77.36	99.51
SD	10.52	9.054	9.23	0.83



Graph 7: Hemodynamic parameters on admission

Table 8: Duration of presentation to hospital following trauma

DURATION OF PRESENTATION TO HOSPITAL FOLLOWING TRAUMA	NUMBER	PERCENTAGE
LESS THAN LESS THAN ONE HOUR	4	4.00%
BETWEEN 1- 2 HOURS	4	4.00%
BETWEEN 2-3 HOURS	18	18.00%
BETWEEN 3-4 HOURS	17	17.00%
BETWEEN 4-5 HOURS	33	33.00%
BETWEEN 5-6 HOURS	21	21.00%
BETWEEN 6-7 HOURS	3	3.00%
TOTAL	100	100.00%

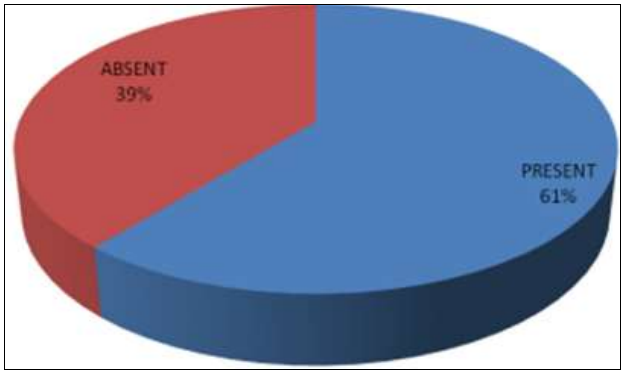


The most common duration of presentation to hospital following trauma was between 4-5 hours seen in 33% of the cases

Graph 1: Duration of presentation to hospital following trauma

Table 9: Use of splint

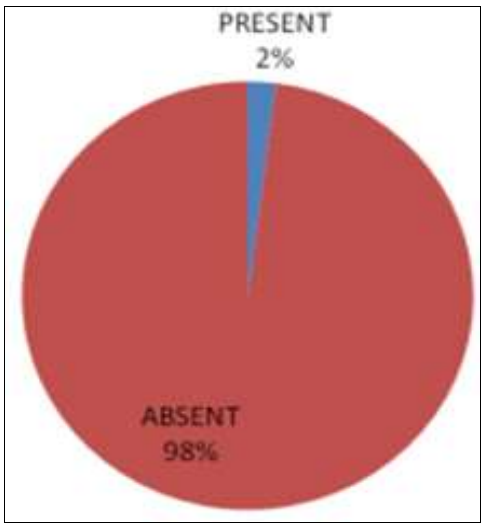
SPLINT	NUMBER	PERCENTAGE
PRESENT	61	61.00%
ABSENT	39	39.00%
TOTAL	100	100.00%



Graph 9: Use of splint

Table 10: Urine for fat globulin pre operatively

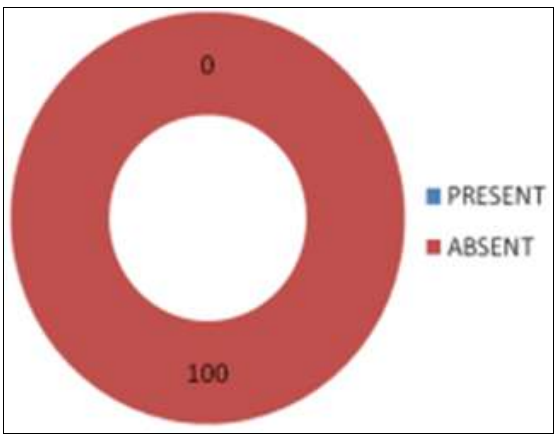
URINE FOR FAT GLOBULIN PRE OPERATIVELY	NUMBER	PERCENTAGE
PRESENT	2	2.00%
ABSENT	98	98.00%
TOTAL	100	100.00%



Graph 10: Urine for fat globulin pre operatively

Table 11: Urine for fat globulin pre operatively

URINE FOR POST OPERATIVELY	NUMBER	PERCENTAGE
PRESENT	0	0.00%
ABSENT	100	100.00%
TOTAL	100	100.00%



Graph 10: Urine for fat globulin pre operatively

Discussion

Fat emboli occur in all patients with long-bone fractures, but only few patients develop systemic dysfunction, particularly the triad of skin, brain, and lung dysfunction known as the fat embolism syndrome (FES). The incidence of FES varies from 1–29%. The aetiology may be traumatic or, rarely, nontraumatic.

Various factors increase the incidence of FES. Mechanical and biochemical theories have been proposed for the pathophysiology of FES. The clinical manifestations include respiratory and cerebral dysfunction and a petechial rash. Diagnosis of FES is difficult. Lipiduria or lipuria is the presence of lipids in the urine. When lipiduria occurs, epithelial cells or macrophages contain endogenous fats. When filled with numerous fat droplets, such cells are called oval fat bodies. Oval fat bodies exhibit a "Maltese cross".

Presence of fat globules in blood and urine point to a diagnosis of fat embolism rather FES and is one of the criteria laid down in the diagnostic criteria of FES. In this study we evaluated 100 cases of long bone fracture in them we found fat globules in 2%, Both of the cases were males, both had sustained open fracture of the tibia both had presented after 4 hours to the hospital, both had a BMI of above 30, one was 55 year old males who had sustained vehicular accident, the other was a 27 year old male who had sustained injury following fall from height at a work place.

Here we compare our findings with other findings

AGE GROUP The most common age group was 21- 30 years with 40% of the study population, P= 0.0065. Fabian *et al* (68) in their study stated that the mean age was 31.3 years in our study the mean age was 31.78 years

HYPOXEMIC IN FES Bulger *et al*. found that patients who are hypoxemic are always at a higher risk of developing FES and its complications, in the present study both cases who had a positive fat in urine had a lower oxygen saturation as compared to the rest (10).

Fabian *et al*. (68) Bulger *et al*. [10].

Barson (27) Pell AC (28) and Vichinsky (29) also stated similar findings.

Incidence of FES

Bulger *et al* 10 in their retrospective study, reported an incidence of < 1% (incidence of 0.9% of all patients with long-bone fractures), while Fabian *et al* (68) in 1 their prospective study, reported an incidence of 11–29%, in the present study we had a 25 incidence.

Gender and FES

Males predominated the study population with 88% p =0.008., Males predominated the study 66% as in a study by Fabian *et al* (68)

Cause of FES

Vehicular accidents were the commonest cause seen in 67% as in a study by Fabian *et al* (68)

Obesity and FES

Obesity 56% had normal weight, 34% were overweight and 10% obese The link between obesity and severity of FSS was demonstrated by Alexander Katz in the year 1924 as he stated that as the severity of the grade on histology there was a concomitant increase in the severity of fat embolism32. Kronke *et al* in the year 1956 stated as a consequence of altered lipid metabolism after fractures traumatic lipaemia occurs leading to lung fat emboli appear very rapidly

Type of bone fracture

Thirteen patients (48%) had multiple long-bone fractures, and 14 patients (52%) had a single long-bone fracture. Among all bones, tibia was the commonest of the bone fracture involved 67 cases, followed by fibula in cases and femur in 34 cases. In the present study the most common site of injury was the long bones of which a combination of tibia and fibula was the commonest seen in 44.00%.

Bulger *et al* 10 in their retrospective study stated thirteen patients (48%) had multiple long-bone fractures, and 14 patients (52%) had a single long-bone fracture.

Bulger *et al* 10 Seven patients (26%) had open fractures, 15 (56%) had closed fractures, and the remaining 5 (18%) had both. In the present study 3% had open fractures.

The examination of urine for fat globulin post operatively was negative in all 100 of the cases. The examination of urine for fat globulin pre operatively was positive in 2% of the cases.

Treatment

The use of splint was seen in 61% of the cases.as compared to Bulger *et al* 10 in which 745 were stabilized.

We had seen the presence of fat emboli in two patients, both were males both had sustained fracture of the shaft of the left femur both presented after 4 hours and 5 hours after injury, both had sustained vehicular accident.\

Conclusion

- The present study we found that urine fat globulins in fractures involving the long bone are present in two percent of cases.
- In both cases the patients had sustained multiple bone fractures.
- There was a delay in presentation to the hospital of more than 4 hours in both cases.
- Both patients had an elevated BMI.
- The objective was to see if fat globulins in fractures involving the long bones were related to complications

Fig 1: Reddish brown non-palpable petechiae

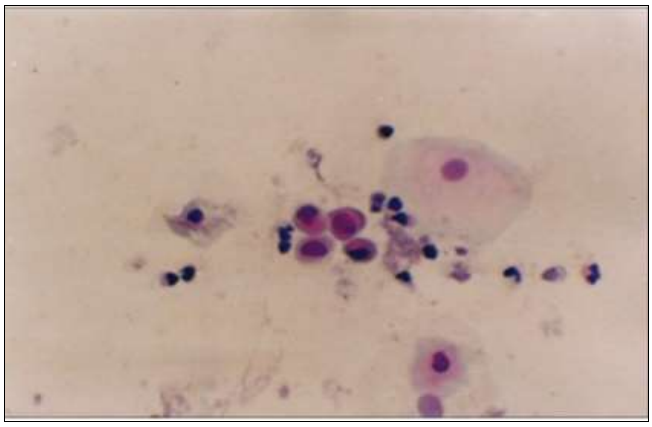


Fig 2: Fat in sputum

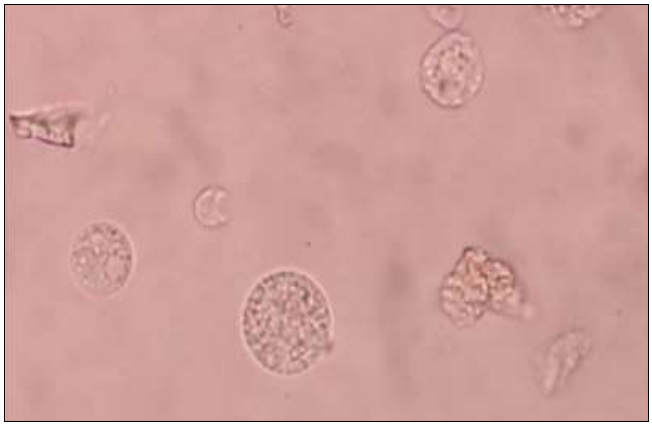


Fig 3: Fat in Urine

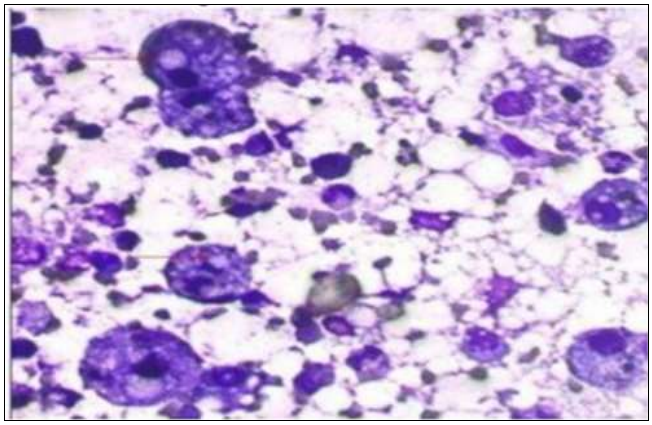


Fig 4: Bronchoalveolar lavage shows the presence of fat globules

Fig 5: Helical chest CT scan for pulmonary embolism

Conflict of Interest
Not available

Financial Support
Not available

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