# An analysis of Survival and Mortality among Patients Admitted to Surgical ICU in Ibin Sina Hospital in Mukalla City, Yemen

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## Abstract

Intensive Care Unit (ICU) is an important unit that takes care of patients with severely life-threatening illnesses and injuries in order to maintain normal body functions. This study aims to estimate survival and mortality among patients admitted to Surgical ICU (SICU ) in Ibin Sina hospital in Mukalla city. A total of 320 patients records from surgical ICU were reviewed during the last six months in 2018 to estimate the survival and mortality rate using Kaplan Meier to evaluate Hazard Rate (HR) using Cox regression. Mortality rate was found 20%. Out of all dead patients 52 (81.2%) were males, about 50% of admitted cases were due to trauma, and 140 (43.8%) are from rural area. The mean survival time was193.1 hours (95% CI:182.0- 204.2) for urban area vs 136.4 hours (95% CI: 122.4-150.3) for rural area. HR among patients from rural area was 3.7 times (95% CI 2.0-6.8) compared to urban area, females HR was 2 times higher than the males and HR among those patients with non abdominal causes was 1.9 times than those with trauma. Although Yemen is a poor country the percentage of mortality in SICU was only 20% which is less than the mortality rate in SICUs in many other low-income countries. HR was higher among females, patients from rural area and patients with non abdominal causes.

**Key words**: Mortality, SICU, Mukalla, Yemen.

**Introduction:**

Intensive Care Units take care of patients with the most severe and life-threatening illnesses and injuries; which require constant, close monitoring and support from special equipments and medication in order to maintain normal body functions. They are staffed by highly trained doctors and critical care nurses who specialize in caring for seriously ill patients [14].

Critical care support and intervention prevent deaths. Factors that influence mortality need to be investigated to see the trend in our set-up and how these factors can be improved. There are some patients who are admitted directly to the SICU and others are admitted to surgical department for surgical procedures and then transferred to the SICU because of the deterioration of their health.

Patients who are admitted to surgical intensive care unit (SICU) have a variable disease process and a wide range of disease severity. The mortality in ICU hospitals is usually different . In 17 European countries overall, 1,113 (19.1%) patients died in the ICU [1] . In Turkey, the ICUs' mortality rate was 46.3% [5].

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The causes of high percentage of deaths in ICU are different from country to other and depends on the availability of the ICU equipped with modern equipment and qualified doctors with a sufficient number of experienced nurses. In Yemen, as one of the developing countries, and currently suffering from war conditions, the level of health care is less developed than in the developed countries of the world.

**Methods**:

In this study 320 patients were admitted to Surgical Intensive Care Unit (SICU) in Ibin Sina Hospital at the period of six months from 1 July to 31 December 2018. The data were taken from records of the SICU during this period. The age was divided into two groups by the median (≤ 33 and >33 years**).** The main objective of this study was to estimate the survival rate and Hazard Rate (HR) of patients admitted in this surgical unit and to evaluate the factors which may lead to death. Kaplan Meier curves were used to compare survival distribution of data dealing with differing survival times (times to death), especially when all the subjects do not continue in the study. Cox regression was used to evaluate HR of factors affecting the occurrence of event (death).

**Results:**

The number of cases recruited in this study was 320 admitted for the first time to the surgical intensive care unit (SICU). There was no any case readmitted to ICU.

Table (No.1) shows the characteristics of the

study sample. Out of the total number of admitted patients, 64 (20%) died in different times. The rest 256 patients either cured or shifted to surgical department to continue treatment. The mean age of all patients was 34.4±18.8 years, and the mean time of stay in ICU was 3.28±1.94.

Using t. test analysis, there was no significant difference between age of patients who died or survived during this study p.value was 0.337. The mean age of patients who survived was 33.9±18.4 years and ranges between 5-75 years while for patients who died was 36.5±20.4 years and the range was 3-70 years.

The mean time of stay of patients who died or censored was (3.34 ±1.8 and 3.26 ±1.9 days respectively) and was not significant (t. test p. value was 0.77).

Regarding gender, the number of females in this study was 54 (16.9%) while the number of males was 266 (83.1%). The majority of patients who died (81.2%) were males.

The number of older patients (>33 years ) who died was 34 (53.1%) which was higher than the number of younger patients (≤ 33 years ).

About 50% of admitted cases to SICU were due to trauma, while the minimal percentage of admitted patients (13.1%) were due to abdominal sepsis.

Based on Chi square we found that there was significant difference between status and place of residence of patients and with their diagnosis, (p. value was: 0.00 and 0.001 respectively).

In this table also the total number of patients admitted from urban area were 180 (56.2%) compared with patients referred from rural area 140 (43.8). Out of all dead patients the number of patients from rural area was 48 (75%) which was higher compared with16 (25%) of patients referred from urban area.

Regarding diagnosis of patients admitted to SICU the number of patients who died with non abdominal causes was 34 (53.1%) which was higher than patients died due to trauma 18 (28.1%) or patients died with abdominal sepsis 12 (18.8%).

**Table (No.1): The differences between status of patients and their characteristics using Chi$^2$ analysis.**

| Characteristics | | Status | | Total F = 320 (100%) | Chi $^2$ P. Value |
|---|---|---|---|---|---|
| | | Censored f 1= 256 (80%) | Died f 2= 64 (20 %) | | |
| **Gender** | **Female** | 42 (16.4) | 12 (18.8) | 54 (16.9) | 0.388 |
| | **Male** | 214 (83.6) | 52 (81.2) | 266 (83.1) | |
| **Age group** | **≤ 33 years** | 112 (43.8) | 30 (46.9) | 142 (44.4) | 0.377 |
| | **>33 years** | 144 (56.2) | 34 (53.1) | 178 (55.6) | |
| **Residence** | **Rural** | 92 (35.9) | 48 (75.0) | 140 (43.8) | **0.000** |
| | **Urban** | 164 (64.1) | 16 (25) | 180 (56.2) | |
| **Diagnosis** | **Abdominal sepsis** | 30 (11.7) | 12 (18.8) | 42 (13.1) | **.001** |
| | **Non abdominal causes*** | 86 (33.6) | 34 (53.1) | 120 (37.5) | |
| | **Trauma** | 140 (54.7) | 18 (28.1) | 158 (49.4) | |
| **Total** | | 256 (80%) | 64(20%) | 320 (100) | |

* Non abdominal causes such as burns, diabetic foot, cancers, chest diseases

Using Kaplan- Meier Survival Analysis was used to examine the distribution of time-to-event variables and to compare the distribution by levels of residency. (Table 2) shows that the mean of survival time for people living in urban area was higher than those coming from rural area 193.125 (95% CI:182.034- 204.216) vs 136.362 (95% CI: 122.402-150.322 hours). This indicates, that the time to death among urban was shorter among patients referred from rural area than patients from urban area.

The median for urban was not applicable (the curve of urban did not cross the median line of 50% (Figure No.1).

**Table (No. 2 ) Means and Medians for Survival Time According to Residency**

| Residence | Mean[a] | | | | Median | | | |
|---|---|---|---|---|---|---|---|---|
| | Estimate In hours | Std. Error | 95% Confidence Interval | | Estimate | Std. Error | 95% Confidence Interval | |
| | | | Lower Bound | Upper Bound | | | Lower Bound | Upper Bound |
| Rural | **136.362** | 7.122 | 122.402 | 150.322 | **120.000** | 5.530 | 109.161 | 130.839 |
| Urban | **193.125** | 5.659 | 182.034 | 204.216 | . | . | . | . |
| Overall | 167.089 | 5.135 | 157.025 | 177.153 | . | . | . | . |

a. Estimation is limited to the largest survival time if it is censored.

Table (3) showed the three tests of equality of survival distributions for the different levels of residence using the statistics tests: Log Rank, Breslow and Generalized Wilcoxon. The results of all tests showed significant value (less than 0.05) indicating that there is significant difference in the survival time of residence levels where urban level is better than rural level.

**Table (No. 3) Overall Comparisons**

| | Chi-Square | df | Sig. |
|---|---|---|---|
| Log Rank (Mantel-Cox) | 33.898 | 1 | .000 |
| Breslow (Generalized Wilcoxon) | 19.278 | 1 | .000 |
| Tarone-Ware | 25.338 | 1 | .000 |

Figure (1) shows the cumulative probability of surviving a given time which is seen on the Y-axis. The figure shows that the level of urban group is better than the level of rural group. Moreover, as the number of hours increases, the two curves appear to get farther apart. If two patients died each of them from different group at the same survival time of 96 hours, the cumulative survival proportion of the person from urban area is 0.884 and is better than the cumulative survival proportion of the person from rural area which is 0.699 [11] .

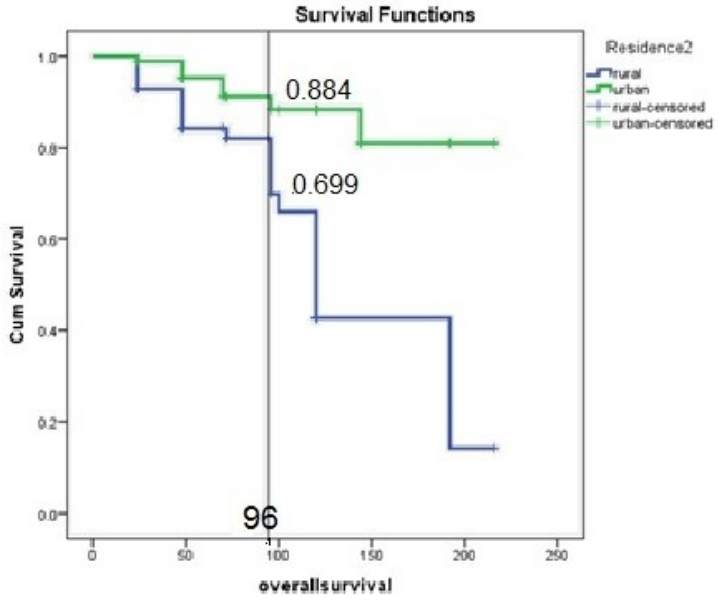


**Figure (No.1) The cumulative survival proportion of two dead persons at the same survival time of 96 hours**

Cox regression was used to identify the coefficients affecting survival rate and to estimate the Hazard Ratio for each coefficient.

As shown in table[4] the omnibus tests revealed that the excepted time model was better than the basic model. The chi-square change from previous step is the difference between the model at the previous step and the current step and was significant indicating that the model coefficients performed well (Table 4).

As seen in table (5) there was significant Hazard Rate (HR) for the coefficients; residence, diagnosis and gender (Sig.: 0.00, 0.033 and 0.04 respectively).

It was found that the HR was higher among patients living in rural area 3.7 times than patients living in urban area (95% CI 2.049-6.759). Regarding the diagnosis only non abdominal causes was significant and the HR was 1.927, (95% CI; 1.056-3.519) which indicated that the hazard rate among those patients with non abdominal causes was 1.9 times higher than those with trauma. Also for gender the females HR was 2 times higher than the males.

**Table No.4. Omnibus Tests of Model Coefficients[a]**

| -2 Log Likelihood | Overall (score) | | | Change From Previous Step | | | Change From Previous Block | | |
|---|---|---|---|---|---|---|---|---|---|
| | Chi-square | df | Sig. | Chi-square | df | Sig. | Chi-square | Df | Sig. |
| 596.410 | 41.488 | 5 | .000 | 41.170 | 5 | .000 | 41.170 | 5 | .000 |

a. Beginning Block Number 1. Method = Enter

**Table (No.5): Cox regression analysis to estimate hazard rate for each covariate**

| Groups | Subgroup | B | Sig. | HR | 95.0% CI | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| **Residence** | Urban | | | 1 | | |
| | Rural | 1.314 | **.000** | 3.722 | 2.049 | 6.759 |
| **Diagnosis** | Trauma | | .091 | 1 | | |
| | Abdominal sepsis | .590 | .124 | 1.803 | .851 | 3.823 |
| | Non abdominal causes | .656 | **.033** | 1.927 | 1.056 | 3.519 |
| **Age group** | ≤ 33 years | | | 1 | | |
| | > 33 years | .240 | .348 | 1.272 | .770 | 2.099 |
| **Gender** | Male | | | 1 | | |
| | Female | .704 | **.040** | 2.021 | 1.034 | 3.949 |

**Discussion:**

The percentage of admitted females in SICU in many studies is usually less than males. In our study the female percentage was around 17% comparing with males which was around 83%, while in the result of studies done in Karachi, Pakistan [13] , Ohio [10] and Astria [6] the percentage of females was also lower than males and was (32% to 68%, 36.0% to 64.0 % and 35.4% to 64.6% respectively). Although rate of percentage was 1:2 in our study was 1:4. In a cohort study done in Canada [9] the male percentage was also higher (57.1%) than females.

As most of patients admitted to SICU due to injuries (49.4%), we expect that the increase in the number of men and the smaller number of women is due to the fact that most of the women stay at their homes and are not frequently exposed to exit and exposure to injuries, and that if they need to work outside the house, they will not accept heavy work and so will not be exposed to injuries as men.

The mean age of all patients in our study was 34.4±18.8 years. The mean age of patients in a study from Pakistan [13] was higher and estimated as 49 ±18 years.

Mortality rate in our study was 20% which is nearly similar to mortality in Congo 19.79% [7] and higher than Thailand 9.61% [4] but less than many other countries such as Pakistan 45.3% [13 ], Brazil 26.1% [2], Ethiopia 35.4% [12] , Greece 39% [8], and China 48.7% [3] .

In this study the mean time of stay in SICU of all patients was 3.28±1.94 days, while in Karachi [13] the length of the original SICU stay was nearly similar and estimated as 5.6 ± 4.8 days.

Mortality percentage for gender in this study was higher among males (81.2%) compared to females, and increased with age. The percentage was (53.1%) among older patients (> 33 years) in this study which is similar to a study done in Congo [7] where the percentage of mortality was 53.3% among older patients but only at age group 50-69 years old.

The mortality in SICU among patients coming from rural area was (75%) compared to patients coming from Urban area (25%). The causes of higher percentage among rural patients is that; in rural area the patients who are in severe critical conditions usually can't benefit from optimal therapeutic interventions and they have chronic history of disease and suffer more from infectious pathologies. Delayed transfers or late consultations at arrival of patients for admission, could be a factor explaining the severity of illness in these patients.

**Conclusion:**

Although Yemen is a poor country, the percentage of mortality in SICU was only 20% and is less than the mortality rate in ICUs in many other low-income countries. Three quarters of dead patients were referred from rural area.

**Recommendations**:

We appeal to the competent decision makers to provide the necessary facilities and modern equipment in hospitals in the rural areas and to provide the necessary medical staff to improve the performance in dealing with difficult cases and the possibility of rapid transfer safely to the best centers in the city if required to improve the outcome of patients.

**Ethical approval:**

The study was approved by the ethical committee of College of Medicine and Health Sciences HUCM, Yemen. Presentation of results is anonymous and data was kept confidential.

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# تحليل البقاء على قيد الحياة والوفاة بين المرضى الذين أدخلوا إلى وحدة العناية المركزة الجراحية في مستشفى ابن سينا في مدينة المكلا ، اليمن

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**الملخص**

وحدة العناية المركزة هي وحدة مهمة تهتم بالمرضى الذين يعانون من أمراض وإصابات خطيرة تهدد حياتهم من أجل الحفاظ على وظائف الجسم الطبيعية. تمت مراجعة 320 ملفا لمرضى وحدة العناية المركزة الجراحية خلال الأشهر الستة الأخيرة من عام 2018 لتقدير معدل البقاء على قيد الحياة والوفاة باستخدام كابلان ماير ولتقويم معدل المخاطر باستخدام اختبار كوكس. كان معدل الوفيات 20 ٪. وقد وجد أن من بين جميع المرضى المتوفين 52 (81.2٪) كانوا من الذكور ، حوالي 50٪ من الحالات التي تم قبولها كانت بسبب الصدمة ، و 140 (43.8٪) من المناطق الريفية. كان متوسط البقاء على قيد الحياة 193.1 ساعة (مجال الموثوقية 95٪: 182.0 – 204.2) للمنطقة الحضرية مقابل 136.4 ساعة (مجال الموثوقية 95٪: 122.4–150.3) وكان معدل الخطوره بين المرضى القادمين من المناطق الريفية 3.7 مرة (مجال الموثوقية أعلى من المناطق المدنية 6.8–2.0% CI95) . كذلك معدل الخطوره بالنسبة للنساء مرتين أعلى من الذكور أما المرضى الذين يعانون من اصابات مرضيه فى أجزاء من الجسم غير البطن فكانت نسبة الخطورة عندهم 1.9 مرة من أولئك الذين يعانون من الصدمة.على الرغم من أن اليمن بلد فقير فإن نسبة الوفيات في وحدة العناية المركزه كانت 20٪ فقط وهو أقل من معدل الوفيات في وحدات العناية المركزه في العديد من الدول الأخرى منخفضة الدخل. كان معدل الوفيات أعلى بين الإناث ، والمرضى من المناطق الريفية والمرضى الذين يعانون من أسباب فى أجزاء أخرى غير البطن.

**الكلمات المفتاحية:** الوفيات، العناية المركزه الجراحية، المكلا، اليمن.