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Research Article

FRAILITY IS A GOOD INDICATOR OF LENGTH OF HOSPITAL STAY IN PATIENTS SUFFERING FROM BACTERIAL MENINGITIS

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Abstract:

Purpose: The purpose of the study is to analyze the effect of frailty index on the length of hospital stay.

Method: After approval from Hospital Ethical committee data was taken from the previous records (hospital database) of patients who were admitted to Ledy Reading Hospital, Peshawar for bacterial meningitis. The data was extracted from 2018 to 2021. SPSS 20 version was used for the data analysis.

Results: Among 204 (62.2%) less frail patients, 188 patients (92.15%) had a hospital stay of 0-7 days and 16 patients (7.84%) had a hospital stay of 8-14 days. While in 124 severely frail patients (37.8%), 11 patients (8.9%) had a hospital stay of 0-7 days, 106 patients (85.5%) had a hospital stay of 8-14 days and 7 patients (5.6%) had a stay of greater than 14 days.

Conclusion: We found that severely frail patients ($mFI \geq 3$) had longer hospital stay compared to less frail patient ($mFI \leq 2$). This study demonstrated that frailty, not the age, is the independent indicator of poor clinical outcomes and length of hospital stay.

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INTRODUCTION:

Meningitis

Meningitis is an inflammation of meninges, particularly the arachnoid and the pia maters^[1]. It may be caused by bacteria, viruses, fungi and protozoa. Bacterial meningitis commonly present with a classic triad of fever, neck stiffness and altered mental status; however reliance on these three signs may result in more than 50% Of cases of bacterial meningitis being missed^[2].

Bacteria includes *Streptococcus pneumoniae*, *Neisseria meningitidis*, *Listeria monocytogenes* are common among adults. Bacteria need access to the meninges to cause meningitis. There are several mechanisms for entry. Bacteria in the blood can cross the blood-brain barrier. This can only be accomplished by certain bacteria, most notably *N. meningitidis* and *S. pneumoniae*. Direct extension of sinusitis or otitis media to the central nervous system may occur. Dural defects, either congenital or acquired, allow bacteria to enter the CNS. Nosocomial bacterial meningitis is the result of the manipulation of the meninges during neurosurgical procedures. Invasion of bacteria into the subarachnoid space results in inflammation of the meninges^[3]. Patients presumed to have bacterial meningitis should receive a lumbar puncture to obtain a cerebrospinal fluid (CSF) sample. The CSF should be sent for Gram stain, culture, complete cell count (CBC), and glucose and protein levels. Bacterial meningitis typically results in low glucose and high protein levels in the cerebrospinal fluid. As CSF glucose levels are dependent on serum glucose levels, the CSF to serum glucose ratio is considered more reliable parameter for the diagnosis of acute bacterial meningitis than absolute CSF glucose levels.

A neutrophil predominance on CSF cell count would be expected.

The diagnosis would be confirmed with bacteria identified on gram stain or culture. A non-contrast CT scan of the head should be performed before lumbar puncture to see if the patient has a risk of herniation. Risk factors include papilledema on the examination, new onset seizures, focal neurologic deficits. Consider delaying the lumbar puncture if the patient has unstable vital signs, coagulation abnormalities, or has had a recent seizure. Start treatment with antibiotics empirically if testing is delayed. Blood cultures should be obtained as 53% of patients have concurrent bacteremia. Elevated C-reactive protein or procalcitonin levels would suggest a bacterial rather than viral etiology^[4].

It is estimated that 25% of people with meningococcal disease, will have complications. Complications are not uncommon in other causes of bacterial meningitis. Severity can vary from person to person, and they can be temporary or permanent. Delayed therapy can result in vascular inflammation with cerebral infarction. Other long-term complications include seizures, problems with memory and concentration, problems with movement, balance and coordination, learning difficulties, speech problems, vision loss and hearing loss^[3].

Frailty index

Frailty is defined as loss of physiological reserves due to multiple comorbidities^[5]. This concept is used in Geriatric Medicine to identify older individuals at increased risk for poor clinical outcomes^[6]. Historically increasing age has been associated with poor clinical outcomes without consideration of frailty or how multiple comorbidities impact the clinical outcomes. However many evidences suggest that frailty is a better predictor of clinical outcomes than age^[7]. This frailty concept has been adopted into a frailty index- a value which represents the severity of frailty. The Canada Study of Health and Aging (CSHA) developed a 70 item scale (CSHA-FI) based on this concept using cognitive function, nutritional status, gait, grip strength, co-morbidities and other factors as measurements. The CSHA FI has been shown to be effective in predicting morbidity and mortality in patients^[8]. Many of the factors in the CSHA-FI are difficult to be measured in patients and are not collected uniformly in clinical settings, so making it difficult to be used in completeness both clinically and from a research perspective. As such, the index has been re-defined and abbreviated in many databases and different specialties. Within the National Surgical Quality Improvement Program by the American College of Surgeons (NSQIP), there are sixteen variables, mapping to 11 factors that match to the original CSHA-FI^[7] that have been combined to create a "modified frailty index" (mFI). The mFI has been proven to adequately reflect frailty and has been shown to predict clinical outcomes. Through the past few years, however, certain NSQIP variables have changed and been removed, based on the goals of the database for quality improvement. Year 2012 was the last year that contained the 16 variables that made up the 11 factor mFI. In 2015, only 5 out of the original 16 variables which make up 5 of the 11 factors remained. The original 11-factor modified frailty index (mFI-11), has shrunk to a 5 factor predictive index. The predictive power and usefulness of this five factor index (modified frailty index 5, mFI-5), which include hypertension, DM,

COPD, CHF and dependent functional status, {Table 1} has been studied in different specialties.

S.No	mFI	Score
1	Hypertension	1
2	COPD	1
3	Diabetes Mellitus	1
4	Congestive Heart failure	1
5	Dependent functional status	1

METHODS AND MATERIALS:

Inclusion and exclusion criteria

All those patients suffered from bacterial meningitis, confirmed by cerebrospinal fluid (CSF) analysis and culture, were included in the study. Patients with other causes of meningitis or with insufficient data regarding frailty index and hospital stay were excluded from the study.

Frailty index

In our study, we used modified frailty index 5, mFI5. We broadly divided frailty Index into less frail ranging from 1 to 2 and severe frail ranging from 3 to 5.

Data source

After approval from Hospital Ethical committee data was taken from the previous records (hospital database) of patients who were admitted to Leady Reading Hospital, Peshawar for bacterial meningitis. The data was extracted from 2018 to 2021.

RESULTS:

We identified 328 patients of bacterial meningitis from the hospital database from 2018 to 2021 who met our inclusion criteria. In our study the median age was 55 years with higher percentage of patients from 41 to 50 year (Table 2). Males were 54.3 % while females were 45.7 % (Table 3). 204 patients (62.2%) were less frail and 124 patients (37.8%) were severe frail (Table 4).

Age group	Frequency	Percentage (%)
21-30	75	22.86
31-40	59	17.98
41-50	108	32.92
51-60	60	18.29
Above 60	26	7.92
Total	328	100

Table 3: Frequency of genders

	Frequency	Percent	Cumulative Percent
male	178	54.3	54.3
female	150	45.7	100.0
Total	328	100.0	

Table 4: Frequency table of Frailty

Frailty	Frequency	Percent	Cumulative Percent
Less frail	204	62.2	62.2
Severe frail	124	37.8	100
Total	328	100.0	

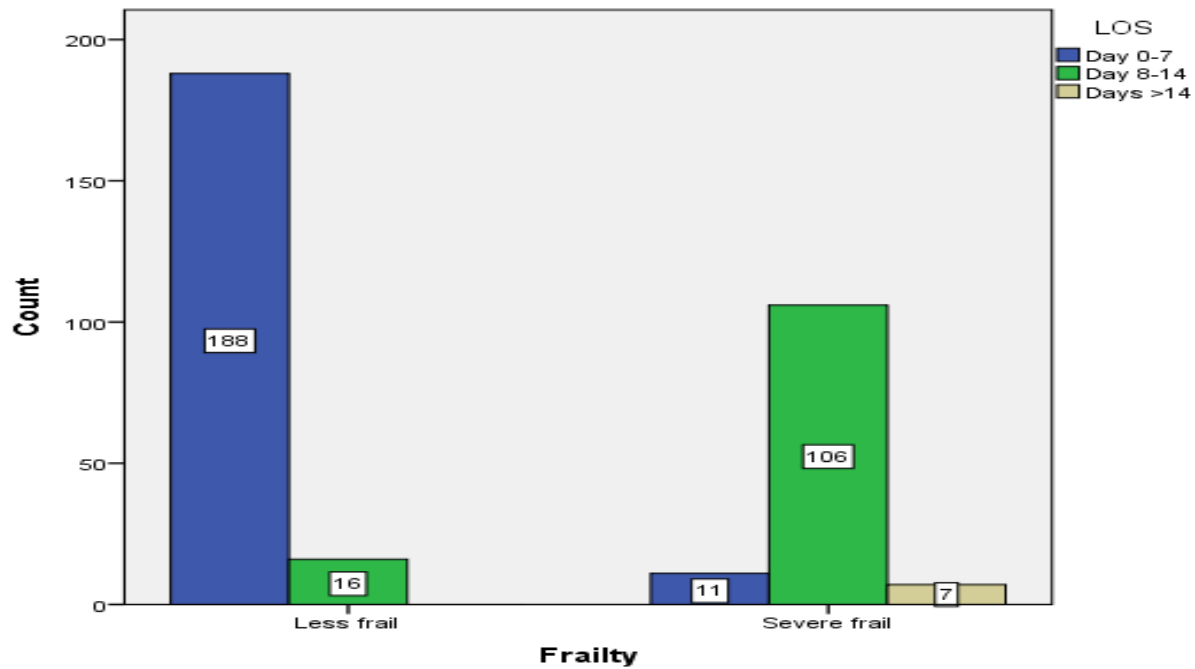
In our study, the length of hospital stay of patients suffered from bacterial meningitis was the main focus. We found that severely frail patients (mFI ≥ 3) had longer hospital stay compared to less frail patient (mFI ≤ 2).

Among 204 (62.2%) less frail patients, 188 patients (92.15%) had a hospital stay of 0-7 days and 16 patients (7.84%) had a hospital stay of 8-14 days. While in 124 severely frail patients (37.8%), 11 patients (8.9%) had a hospital stay of 0-7 days, 106 patients (85.5%) had a hospital stay of 8-14 days and 7 patients (5.6%) had a stay of greater than 14 days (Table 5).

Table 2: Age distribution of patients

Table 5: Crosstabulation showing frequency and percentage of patients in less and severely frail patient

Frailty * LOS Crosstabulation						
			LOS			Total
			Day 0-7	Day 8-14	Days >14	
Frailty	Less frail	Count	188	16	0	204
		% within Frailty	92.2%	7.8%	0.0%	100.0%
	Severe frail	Count	11	106	7	124
		% within Frailty	8.9%	85.5%	5.6%	100.0%
Total		Count	199	122	7	328
		% within Frailty	60.7%	37.2%	2.1%	100.0%

**Figure 1:** Showing length of hospital stay and frailty

DISCUSSION:

Physician scientists across the world are working on frailty as indicator of poor clinical outcomes [9]. Many studies across different specialty have shown that severely frail patients have poor clinical outcomes compared to those who are less frail [7,9,10]. In our study we focused to find the effects of frailty index (mFI5), which is measured by hypertension, DM, CHF, COPD and dependent functional status, on the length of hospital stay. We found significant results of the effect of frailty on the length of hospital stay in patients who Suffered from bacterial meningitis. As shown from the results, the severely frail patients had longer stay at hospital compared to less frail patients. In one of the studies conducted at the Neurosurgery department of UNM hospital, it was proved that severely frail patients who underwent neurosurgical

interventions had longer stay at hospital compared to less frail patients [11].

LIMITATIONS

Limitations of our study are : first, the data is taken from the hospital database, second, limited number of patients were included in the study and 3rd the database did not include the follow up, complications and readmission.

CONCLUSION:

This study demonstrates that frailty not the age is the independent indicator of poor clinical outcomes and length of hospital stay. The more frail are the patients, the more is the length of hospital stay.

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