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Assessment of Acquired Weakness among Critically Ill Patients: Its Prevalence, Severity and Risk Factors

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Abstract:

Background: Intensive Care Unit-Acquired Weakness is a serious complication affecting critically ill patients. It manifests as symmetrical muscle weakness developing rapidly after Intensive Care Unit admission or mechanical ventilation, leading to prolonged recovery and reduced quality of life. **Aim of the study:** To assess the prevalence, severity, and risk factors of acquired weakness among critically ill patients. **Research design:** Descriptive research design. **Setting:** General, trauma, and anesthesia Intensive Care Units at Assiut University Hospital, Egypt. **Sample:** Convenience sample of adults aged 18–65 years admitted to Intensive Care Units for over 48 hours and meeting inclusion criteria. **Tools:** Five tools were used: Tool one: Patient Assessment Tool (two parts). Tool two: Biomedical Data Tool (three parts). Tool three: Muscle Assessment Tool (two parts). Tool four: Patient Risk Factors Assessment Tool. Tool five: Severity of Disease Assessment Tool. **Results:** Intensive Care Unit-acquired weakness was identified in 45% of patients, with 35% had severe weakness. it was significantly associated with mechanical ventilation duration, Intensive Care Unit stay length, and sepsis. Patients with Acquired Weakness had longer hospital stays and poorer functional outcomes. **Conclusion:** Intensive Care Unit-Acquired Weakness is a significant issue among critically ill patients at Assiut University Hospital, with notable prevalence and varying severity. It shows strong association with major risk factors influencing patient condition. **Recommendations:** Enhance nurse training on Intensive Care Unit-Acquired Weakness assessment and prevention, implement early mobilization protocols, and conduct further research for effective management strategies.

Keywords: Acquired Weakness, Critically Ill Patient, Prevalence, Risk Factors & Severity.

Introduction:

Intensive Care Unit-Acquired Weakness (ICU-AW) is a prevalent and serious neuromuscular complication affecting critically ill patients, manifested as symmetric proximal limb and respiratory muscle weakness while sparing facial and ocular muscles (**Voiriot et al., 2022)**. ICU-AW is diagnosed using the Medical Research Council (MRC) sum score, with scores below 48/60 indicating (ICU-AW) **(Song et al., 2025)**. It encompasses critical illness polyneuropathy (CIP), critical illness myopathy (CIM), and their combination, critical illness neuromyopathy (CINM) (**Latronico et al., 2023)**.

Numerous risk factors contribute to ICU-AW, including non-modifiable factors such as illness severity, sepsis, multi-organ failure, and older age **(Wang & Long, 2024)**. as well as modifiable factors such as prolonged immobilization, deep sedation, use of corticosteroids, neuromuscular blockers, and poor glucose control. Among these, immobilization and deep sedation are especially significant and preventable contributors to muscle atrophy and ICU-AW. **(Yu et al., 2024)**.

Diagnosing ICU-AW is challenging, particularly in sedated or unconscious patients despite its prevalence. Although widely used, the MRC scale requires patient cooperation to be effective **(Conde et al., 2023)**. ICU-AW is associated with a range of negative outcomes including increased ICU and hospital mortality, prolonged mechanical ventilation, extended hospital stays, higher healthcare costs, long-term disability, and reduced quality of life (**Chhiba et al., 2025**).

Still a lack of local data on its prevalence, diagnostic approaches, and preventive strategies despite the significant impact of ICU-AW. **(Zheng et al., 2024)**. Management strategies are primarily supportive and include optimizing nutrition, glucose control, early mobilization, and physical therapy **(Watanabe et al., 2023).** Preventive strategies such as minimizing deep sedation, avoiding unnecessary neuromuscular blockers, and initiating early physical activity even in mechanically ventilated patients have shown promising results in reducing the incidence and severity of ICU-AW **(Chen & Huang., 2024)**.

Critical care nurses play a vital role in the early detection and prevention of ICU-AW. Their duties include regular muscle strength assessments, initiating early mobilization, ensuring proper nutrition, educating patients and families, and collaborating within multidisciplinary teams to minimize ICU-AW risk and impact **(Formenti et al., 2025)**. Enhancing awareness and applying prevention strategies are essential to improve patient outcomes and reduce ICU-AW burden in critical care settings **(Zhao et al., 2024).** This research aims to explore ICU-AW incidence, associated risk factors, and the effectiveness of combined early mobilization and nutritional interventions in our clinical setting.

Significance of the Study:

Intensive Care Unit-acquired weakness (ICU-AW) was found to be a prevalent and serious complication among critically ill patients, with significant long-term consequences. Globally, intensive care units care for approximately 13–20 million patients annually. The prevalence of ICU-AW was reported to range between 25%–31% in medical ICUs and 57%–74% in surgical ICUs. It developed rapidly sometimes within hours of ICU admission or initiation of mechanical ventilation and often persisted for years, especially among patients who underwent mechanical ventilation for more than 4–7 days or among elderly patients, with an incidence reaching up to 70% **(Elkalawy et al., 2023)**. Sepsis patients are at particularly high risk, with ICU-AW incidence between 50% and 100%, and up to 36% experience persistent muscle weakness post-ICU discharge **(Wu et al., 2021).**

Based on the researcher's clinical experience during two years of training in ICUs at Assiut University Hospitals, it was observed that a total of 1,410 patients were admitted to the ICUs at Assiut University Hospitals during the year 2024. Approximately more than 60% of these critically ill patients developed signs of ICU-acquired weakness. However, this was based on observation without standardized assessment tools. Therefore, this study was conducted to determine the actual prevalence, severity, and risk factors of ICU-acquired weakness at Assiut University Hospitals. **(from April 2023 to April 2024) (Assiut University Hospital Record)**.

Aim of the Study:

The study aim is to assess the prevalence, severity, and risk factors of acquired weakness among critically ill patients.

Research Question:

- What is the prevalence of intensive care unit acquired weakness (ICU-AW)?
- What is the severity of intensive care unit acquired weakness (ICU-AW)?
- What are the risk factors of intensive care unit acquired weakness (ICU-AW)?

Patient and Methods:

Research Design:

A descriptive research design was used in this study.

Setting:

The study was conducted in the Intensive Care Units (ICUs) at Assiut University Hospital, Assiut, Egypt, including the General ICU, Trauma ICU, and Anesthesia ICU.

Sampling:

A convenience sample of adult male and female patients, aged between 18 and 65 years and at risk of developing ICU-acquired weakness, was selected from the Intensive Care Units of Assiut University Hospital. sixty patients who met the inclusion criteria were enrolled in the study. Data were collected over a six-months period, from September 2024 to February 2025.

Inclusion Criteria:

- Patient's age between 18 – 65 years.
- Estimated ICU stay >48 hr.
- Patients should be conscious and able to follow simple commands.
- Patient on mechanical ventilation (who are in the active phase of weaning from mechanical ventilation).
- Simple fracture or trauma.

Exclusion Criteria:

- Unconscious patient (who are uncooperative or unable to participate in assessments).
- Patient with history of mental illness or cognitive impairment.
- Patient with preexisting neuromuscular disease (Myasthenia gravis, Guillain Barré).
- Patients with diseases that could affect motor function.
- Intracranial or spinal cord status affecting motor function.
- Deformity.
- Paralysis.

Tools of the Study:

Five tools were utilized for data collection in this study. Some tools were adapted from previously validated and standardized instruments **(Ray-Barruel, 2022; Morton & Thurman, 2023; Mohamed et al., 2019; Chien et al., 2020; Yang et al., 2023; Darden et al., 2023; Cirik et al., 2025; Zhang et al., 2025)**. Other tools were developed by the researcher after reviewing related literature **(Khalil et al., 2023)** within the study for data collection.

Tool One: Patient Assessment Tool: -

This tool was used to assess patients' conditions based on baseline data adapted from **(Ray-Barruel, 2022)** and includes the following parts:

Part (1): Demographic and Clinical Data: - This part was used to collect baseline personal and medical data, including demographic information (age, gender, marital status, education, occupation), past medical history (e.g., heart disease, diabetes, hypertension), current diagnosis, ICU stay length, and duration of mechanical ventilation.

Part (2): Hemodynamic Assessment Tool: This part was used to assess the hemodynamic parameters including pulse, blood pressure, temperature, and central venous pressure (CVP). Additionally, information about blood transfusion, bleeding, and pain was recorded to provide a comprehensive overview of the patient's clinical status.

Tool Two: Patient Biomedical Data Tool:

This tool was used to assess the patient condition based on baseline biomedical data adapted from **(Morton & Thurman, 2023)** and includes the following parts:

Part (1): Laboratory Assessment Tool: - This part was used to assess the laboratory tests, including complete blood count, arterial blood gases, electrolytes, blood glucose levels, C-reactive protein, erythrocyte sedimentation rate, and creatine kinase (CK).

Part (2): Respiratory Assessment Tool: - This part was used to assess the respiratory status, including respiratory rate (RR), oxygen saturation (SpO2), breathing pattern, chest shape and expansion, skin color, breath sounds, cough assessment, and oxygen use (method and flow rate).

Part (3): Mechanical Ventilation Parameters Assessment Tool: This part was used to assess mechanical ventilation parameters, including mode of ventilation, tidal volume (VT), fraction of inspired oxygen (FiO2), positive end-expiratory pressure (PEEP), minute ventilation, and pressure support (PS).

Tool Three: Muscle Assessment Tool: This tool was used to assess the muscle mass and strength among critically ill patient adopted from **(Mohamed et al., 2019), (Chien et al., 2020)** and **(Yang et al., 2023)** and includes the following parts:

Part (1): Muscle mass assessment of all upper and lower extremities by using measuring tape: - This part was used to assess muscle mass of all upper and lower extremities by measuring circumference using a tape measure **(Chien et al., 2020)**. The mid-arm circumference was measured halfway between the shoulder and elbow to assess the upper arm muscles, while leg circumference measurements targeted the rectus femoris and vastus medialis muscles.

Part (2): Muscle Strength Scale/Medical Research Council (MRC) as an Indicators of ICU-Acquired Weakness incidence: This part was used to assess muscle strength in critically ill patients. The Medical Research Council (MRC) scale, adopted from **(Hermans et al.,2012)** and recently applied by **(Yang et al.,2023)**, was used to manually evaluate both upper and lower limb strength. The diagnosis of ICU-AW was based on grading muscle strength in specific muscle groups. For the upper limbs, assessment included wrist extension, elbow flexion, and bilateral shoulder abduction. For the lower limbs, it included hip flexion, knee extension, and foot dorsiflexion.

Scoring System: Muscle strength in each muscle group was assessed using the six-point Medical Research Council (MRC) system. A score of zero was assigned for no visible contraction; one indicated visible contraction without limb movement; two reflected limb movement not against gravity; three represented movement against gravity through nearly the full range; four denoted active movement against gravity and resistance; and five indicated normal muscle power

Scoring System divided into three levels:

- Scores less than 48 indicate the presence of ICU-AW.
- Scores less than 36 indicate severe ICU-AW.
- Scores between 48 and 60 indicate the absence of ICU-AW.

Tool Four: Patient Risk Factors Assessment Tool:

This tool was used to assess the risk factors associated with the development of ICU-acquired weakness (ICU-AW), developed by **(Khalil et al., 2023)**. The assessed risk factors included obesity, advanced age, smoking, diabetes mellitus, prolonged and severe critical illness, organ failure, exposure to medications negatively affecting myofibers and neurons, immobility, extended mechanical ventilation, prolonged ICU stay, and other ICU-related conditions.

Tool Five: Severity of Disease Assessment Tool:

This tool was adapted by the researcher after reviewing the relevant literature **(Darden et al., 2023)** and **(Cirik et al., 2025).** Clinical prediction scores such as the Acute Physiologic Assessment and Chronic Health Evaluation (APACHE II) are better for predicting severity of disease among intensive care patients and can be measured on all patients who are admitted to the ICU, to determine the level of acuity, as following: **-**

Part (1): Acute Physiologic and Chronic Health Evaluation II (APACHE II Score):

The APACHE II score is still commonly used as index of severity prediction among intensive care patients admitted to ICU, to evaluate the severity of patients' illness within the first 24 hours of ICU admission. This score was adopted by the researcher after reviewing the relevant literature **(Zhang et al., 2025)**.

Scoring system of APACHE-II, included three items: acute physiology, age and chronic health status before the disease. Acute physiologic score includes 12 variables, that were selected based on clinical judgement as to validity and specificity of the measure, breadth of vital organ system coverage, and objectivity, reliability and frequency of measurement. Each variable is weighted from 0 to 4, with 0 being normal and higher or lower scores denoting an increasing deviation from normal. The total score is range from 0 to 71 points, and the score is directly proportional to the severity of the disease and mortality risk.

Methods:

Technique for data collection: the study was conduct through the following phases:

Phase (I): Preparatory Phase: -

- An official permission to carry out the study was obtained from the responsible head of Assiut university hospital in the intensive care units after explaining the aim and nature of the study.
- Approval was obtained from the Ethical Committee, Faculty of Nursing, Assiut University (Proposal No. 1120240858, approved on 26/8/2024).
- Informed consent was obtained from patients.
- The study tools were designed after an extensive review of the related literature

Pilot Study:

A pilot study was conducted on ten percent of the patient sample in the selected setting to examine the applicability, feasibility, efficiency and clarity of the developed tools.

Content Validity and Reliability:

Face Validity of the study tools was assessed by jury of five experts who are specialists in the field of critical care nursing from Assiut University, and necessary modifications were done.

Reliability of the study tool: The reliability of the tests was calculated using the correlation coefficient and estimated by Cronbach's alpha test. The reliability coefficients for the tools were as follows: Tool one = 0.89, Tool two = 0.92, and Tool three = 0.90.

Ethical Consideration:

The research proposal (No.1120240858) was approved by the Ethical Committee on 26/8/2024 at the Faculty of Nursing, Assiut University. There were no risks to the study patients during the conduct of the research. The study adhered to the standard ethical principles in clinical research. Written informed consent was obtained from patients who participated in this study, after explaining the nature and purpose of the study. Confidentiality and anonymity of all participants were assured. Participants had the right to participate, refuse, or withdraw from the study at any time without providing a reason. The privacy of the patients was considered during collection of data.

Phase (II): Data Collection:

This phase involved the actual collection of data from adult patients who met the inclusion criteria and were diagnosed with ICU-acquired weakness. Data collection was conducted over a period of six months in the Intensive Care Units of Assiut University Hospital.

- Following an explanation of the study's aim, procedures, and patients' rights, each eligible patient was identified by the researcher. Those who agreed to participate provided written informed consent prior to enrollment.
- Data were collected through clinical examination, observation, and review of patient records using the prepared study tools
- The researcher assessed the personal and medical data, including demographic information and hemodynamic parameters of patients using tool 1.
- The researcher assessed the Biomedical data, including laboratory investigations, respiratory status, and mechanical ventilation parameters of patients using tool 2.
- The researcher assessed the muscle mass and strength of patients using tool 3.
- The researcher evaluated the risk factors associated with ICU-acquired weakness using tool 4.
- The researcher evaluated the severity of disease among intensive care patients using tool 5.
- At the end of the data collection phase, the prevalence, severity, and potential risk factors for ICU-acquired weakness were determined.

Statistical Design:

The Statistical Package for Social Sciences (SPSS) version 27 was used to code, index, tabulate, and analyze the gathered data. To determine whether two qualitative factors were related, data was displayed in tables and figures using numbers, percentages, means, standard deviation, independent t-test**,** One-Way ANOVA and chi-square test. A P-value of less than 0.05 was considered a statistically significant.

Results:

Table (1): Percentage Distributions of Demographic Data of Studied Patients (N=60)

Demographic Data	Mean& St. Deviation	
Age	50.06±8.66	
	N	**%**
Marital Status		
Single	2	3.3
Married	53	88.3
Divorced	0.0	0.0
Widow	5	8.3
Types of ICU		
General ICU	35	58.3
Anesthesia ICU	15	25
Trauma ICU	9	15
Critical Care Unit	1	1.66
Occupation		
Employer	37	61.7
Dose not work	0.0	0.0
Retired	6	10
House wife	17	28.3
Educational Levels		
Illiterate	7	11.7
Primary	0.0	0.0
Preparatory	17	28.3
Secondary	26	43.3
University	10	16.7

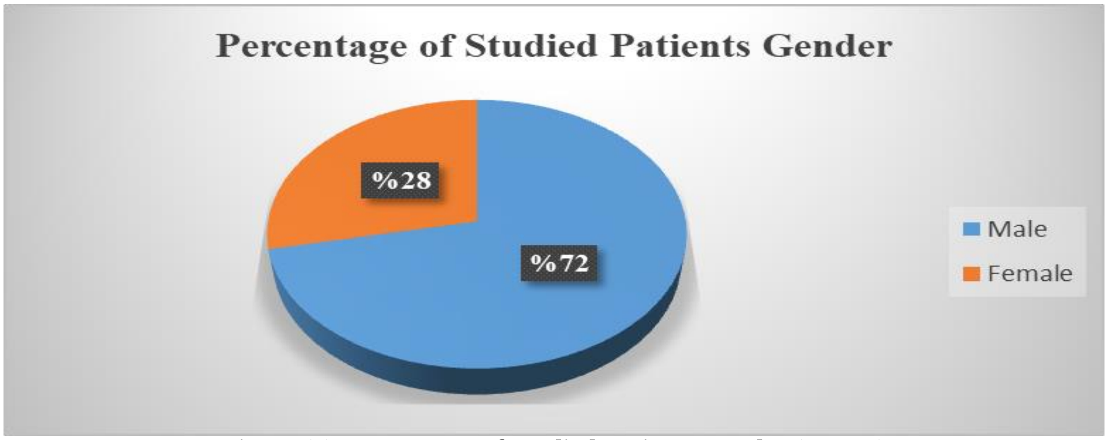

Figure (1): Percentage of Studied Patients Gender (N = 60)

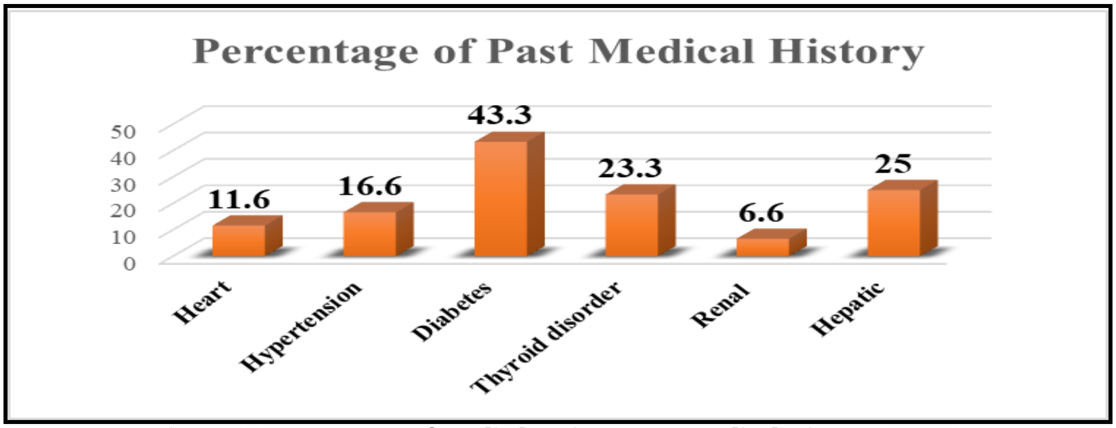

Figure (2): Percentage of Studied Patients Past Medical History (N= 60)

Table (2): Percentage Distribution of Studied Patients Related to Mechanical Ventilation Data (N =60)

Items	N	%
Mechanical Ventilation (M.V)		
Yes	24	40
No	36	60
Duration Connection M. V		
< 3 days	7	11.7
3 -7 days	11	18.3
>7 days	6	10

Table (3): Mean & standard deviation of Muscle mass assessment of all upper and lower extremities by using measuring tape (N= 60)

Items	1st Day	3ed Day	7th Day	P-value
Right Side	**Mean& St.d**	**Mean& St.d**	**Mean& St.d**	
Arm Circumference	43.98±3.89	43.40±3.88	40.78±3.15	0.327
Leg Circumference	78.21± 3.87	76.13± 1.18	74.04± 2.51	0.265
Left Side				
Arm Circumference	43.98±3.89	43.40±3.88	40.78±3.15	0.327
Leg Circumference	78.21± 3.87	76.13± 1.18	74.04± 2.51	0.265

One Way ANOVA test: for qualitative data between the two groups or more
**Significant level at P value < 0.05,* ***Significant level at P value < 0.01.*

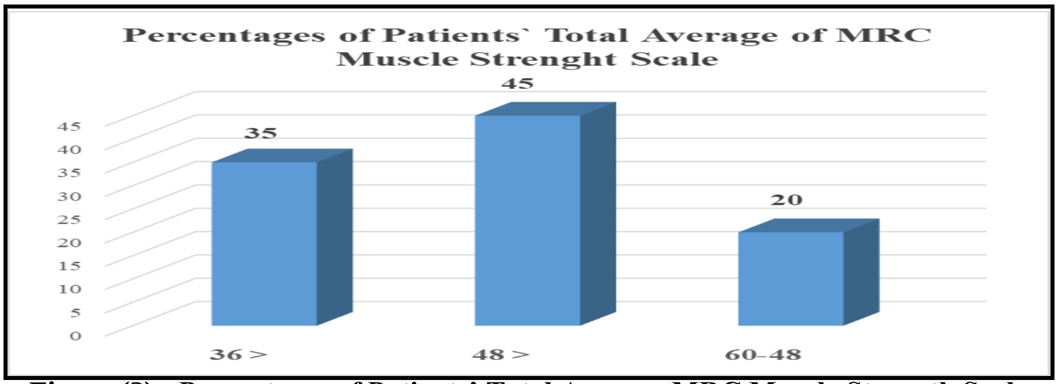

Figure (3): Percentages of Patients' Total Average MRC Muscle Strength Scale

Table (4): Percentage Distribution of the Studied Patients Regarding Risk Factors (N = 60)

Risk Factors	Present		Absent	
	N	%	N	%
Old Age	13	21.6	47	78.3
Female Sex	17	28.3	43	71.6
Obesity	21	35	39	65
Smoking	18	30	42	70
Hypertension	10	16.6	50	83.3
Diabetes	26	43.3	34	56.6
Sepsis	4	6.6	56	93.3
Multiple Organ Failure	0.0	0.0	100	100
Prolonged M. V	24	40	36	60
Prolonged ICU Stay	39	65	21	35
High Lactate Level	29	48.3	31	51.6
Hyperglycemia	16	26.6	44	73.3
Malnutrition	24	40	36	60
Immobilization	60	100	0.0	0.0
Drugs: - Vasoactive Drugs	47	78.3	13	21.6
- Neuromuscular Blockers	24	40	36	60
- Corticosteroids	45	75	15	25
- Sedatives	24	40	36	60
- Certain Antibiotics (Vancomycin, Aminoglycosides).	51	85	9	15

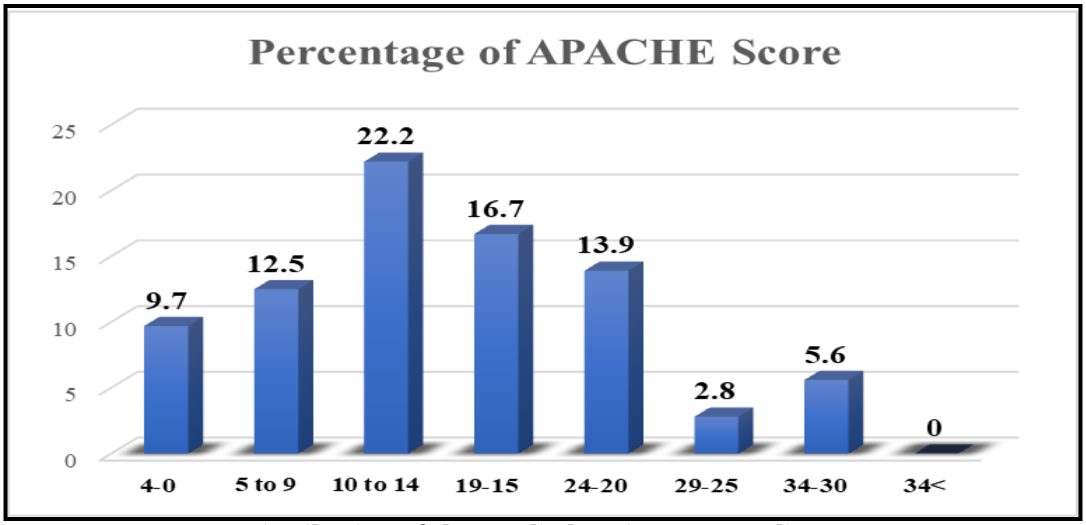

Figure (4): Percentage Distribution of the Studied Patients Regarding APACHE Score (N =60)

Table (5): Relation Between Demographic Data of Studied Patients and MRC Muscle Strength Scale (N= 60).

Demographic Data	MRC Muscle Strength Scale						P. value
	< 36 (35%)		<48 (45%)		48 -60 (20%)		
Age	**50.06±8.66**		**50.06±8.66**		**50.06±8.66**		**0.013***
	N	**%**	**N**	**%**	**N**	**%**	
Sex							
Male	43	71.7	43	71.7	43	71.7	**0.001****
Female	17	28.3	17	28.3	17	28.3	
Marital Status							
Single	2	3.3	2	3.3	2	3.3	0.164
Married	53	88.3	53	88.3	53	88.3	
Divorced	0.0	0.0	0.0	0.0	0.0	0.0	
Widow	5	8.3	5	8.3	5	8.3	
Types of ICU							
General ICU	35	58.34	35	58.34	35	58.34	0.372
Anesthesia ICU	15	25	15	25	15	25	
Trauma ICU	9	15	9	15	9	15	
Critical care unit	1	1.66	1	1.66	1	1.66	
Occupation							
Employer	37	61.7	37	61.7	37	61.7	0.528
Dose not work	0	0	0	0	0	0	
Retired	6	10	6	10	6	10	
House wife	17	28.3	17	28.3	17	28.3	
Educational Levels							
Illiterate	7	11.7	7	11.7	7	11.7	0.321
Primary	0	0	0	0	0	0	
Preparatory	17	28.3	17	28.3	17	28.3	
Secondary	26	43.3	26	43.3	26	43.3	
University	10	16.7	10	16.7	10	16.7	

Chi square test for qualitative data between the two groups or more
**Significant level at P value < 0.05,* ***Significant level at P value < 0.01.*

Table (6): Relation Between Studied Patients` Clinical Data and MRC Muscle Strength Scale (N =60).

Patients` Clinical Data	MRC Muscle Strength scale						P. value
	< 36 (35%)		< 48 (45%)		48 -60 (20%)		
	N	%	N	%	N	%	
Duration Connection M. V							
< 3 days	7	11.7	7	11.7	7	11.7	**0.001****
3-7 days	11	18.3	11	18.3	11	18.3	
>7 days	6	10	6	10	6	10	
Past Medical History							
Heart diseases	7	11.7	7	11.7	7	11.7	**0.014***
Hypertension	10	16.7	10	16.7	10	16.7	
Diabetes	6	10	6	10	6	10	
Thyroid dysfunction	8	13.3	8	13.3	8	13.3	
Renal diseases	4	6.7	4	6.7	4	6.7	
Hepatic diseases	25	41.7	25	41.7	25	41.7	

Chi square test for qualitative data between the two groups or more
**Significant level at P value < 0.05, **Significant level at P value < 0.01.*

Table (7): Relation Between Total Average MRC Score of Studied Patients and Risk Factors (N = 60)

Risk Factors	Total Average MRC Score						P. value
	< 36 (35%)		< 48 (45%)		48 – 60 (20%)		
	N	%	N	%	N	%	
Old Age	13	21.6	13	21.6	13	21.6	**0.027***
Female Sex	17	28.3	17	28.3	17	28.3	0.132
Obesity	21	35	21	35	21	35	0.386
Smoking	18	30	18	30	18	30	0.180
Hypertension	10	16.6	10	16.6	10	16.6	**0.005***
Diabetes	26	43.3	26	43.3	26	43.3	**0.023***
Sepsis	4	6.6	4	6.6	4	6.6	**0.001****
Multiple Organ Failure	0.0	0.0	0.0	0.0	0.0	0.0	
Prolonged M. V	24	40	24	40	24	40	**0.046***
Prolonged ICU Stay	39	65	39	65	39	65	**0.001****
High Lactate Level	29	48.3	29	48.3	29	48.3	**0.008***
Hyperglycemia	16	26.6	16	26.6	16	26.6	**0.093***
Malnutrition	24	40	24	40	24	40	**0.046***
Immobilization	60	100	60	100	60	100	
Drugs: - Vasoactive Drugs	47	78.3	47	78.3	47	78.3	**0.020***
- Neuromuscular Blockers	24	40	24	40	24	40	**0.046***
- Corticosteroids	45	75	45	75	45	75	0.034
- Sedatives	24	40	24	40	24	40	**0.046***
- Certain Antibiotics (Vancomycin, Aminoglycosides	51	85	51	85	51	85	**0.007***

Chi square test for qualitative data between the two groups or more
**Significant level at P value < 0.05, **Significant level at P value < 0.01.*

Table (8): Relation Between Total APACHE Score of Studied Patients and Total Average MRC Score (N= 60)

Total APACHE Score	Total Average MRC Score						P. value
	< 36 (35%)		< 48 (45%)		48 – 60 (20%)		
	N	%	N	%	N	%	
0-4	7	9.7	7	9.7	7	9.7	**0.012***
5-9	9	12.5	9	12.5	9	12.5	
10-14	16	22.2	16	22.2	16	22.2	
15-19	12	16.7	12	16.7	12	16.7	
20-24	10	13.9	10	13.9	10	13.9	
25-29	2	2.8	2	2.8	2	2.8	
30-34	4	5.6	4	5.6	4	5.6	
>34	0.0	0.0	0.0	0.0	0.0	0.0	

Chi square test for qualitative data between the two groups or more
**Significant level at P value < 0.05, **Significant level at P value < 0.01.*

Table (1): Shows the demographic characteristics of the studied patients. Regarding age, the mean ± standard deviation is 50.06 ± 8.66 years. Concerning marital status, 88.3% of the patients are married, while the remaining are single or divorced. Regarding ICU type, 58.3% of patients are admitted to the general ICU, 25% to the anesthesia ICU, and the rest to other types. As for occupation, 61.7% of patients are employed, while others were unemployed or retired. Regarding educational level, 43.3% of patients have completed secondary education.

Figure (1): Shows the percentages of patients' gender. About 72% of the studied patients are male, and 28% are female.

Figure (2): Shows the percentage distribution of patients' past medical history. It is found that 11.6% of the studied patients have a history of heart disease, and 16.6% have a history of hypertension. Additionally, 43.3% have diabetes, and 23.3% have thyroid disorders. About 6.6% and 25% of the studied patients have a history of renal and hepatic diseases, respectively.

Table (2): Shows the percentage distribution of mechanical ventilation data for the studied patients. About 40% of patients are connected to mechanical ventilation. Concerning the duration of M.V connection, 18.3% are connected for 3–7 days, and 10% for more than 7 days.

Table (3): Illustrates the mean and standard deviation of muscle mass assessment for all upper and lower extremities using a measuring tape. Regarding arm circumference, the right and left arms measure 43.98 ± 3.89 cm and 40.78 ± 3.15 cm on the first and seventh days, respectively. For leg circumference, the right and left legs measure 78.21 ± 3.87 cm and 74.04 ± 2.51 cm on the first and seventh days, respectively. There are no statistically significant differences between the measurements of both sides.

Figure (3): Shows the percentages of patients' total average MRC muscle strength scores. It is found that 35% of the studied patients have an MRC score <36, and 45% had a score <48.

Table (4): Shows the percentage distribution of the studied patients' risk factors. It is found that 21.6% of patients are of old age, 28.35% are female, and 35%, 30%, and 16.6% have obesity, smoking, and hypertension, respectively. Regarding chronic conditions, 43.35% have diabetes and 6.6% have sepsis. Concerning ICU-related factors, 40% of patients have prolonged mechanical ventilation, 65% have prolonged ICU stay, and 48.3% have high lactic acid levels. Additionally, 26.6%, 40%, and 100% of patients have hyperglycemia, malnutrition, and immobilization, respectively. Regarding medications, 78.3% receive vasoactive drugs, 75% neuromuscular blockers, 40% corticosteroids, 85% sedations and antibiotics.

Figure (4): Shows the percentage distribution of the studied patients' APACHE scores. It is found that 22.2%, 16.7% of the studied patients have score 10-14 and 15-19 grade of APACHE respectively.

Table (5): Shows that there is a relation between demographic data of the studied patients and MRC muscle strength scale, with statistically significant differences for age and sex p-values= 0.013* and 0.001**.

Table (6): Shows that there is a relation between the clinical data and past medical history of the studied patients and MRC muscle strength scale with statistically significant differences, with p-values = 0.001** and 0.014**.

Table (7): Shows that there is relation between studied patient's risk factors and MRC muscle strength scale with statistical significance differences regarding old age, hypertension, diabetes, prolonged M.V, prolonged ICU stay, hyperglycemia, malnutrition, immobilization and drugs with p- value = 0.027** and 0.005*, 0.023, 0.001, 0.046, 0.001, 0.008, 0.093, 0.046, 0.020, 0.046 and 0.0078 respectively.

Table (8): Shows that there is a relation between the APACHE score of studied patients and MRC muscle strength scale with statistical significance differences, with p-value = 0.012.*

Discussion:

Intensive care unit-acquired weakness (ICU-AW) is a prevalent and serious neuromuscular complication affecting critically ill patients. It is characterized by diffuse, symmetrical muscle weakness not explained by preexisting neuromuscular disorders. Recent studies indicate that ICU-AW remains common, especially among critically ill individuals **(Chuang et al., 2024)**. Multiple risk factors contribute to its development, making early identification and preventive interventions crucial to improving patient outcomes and minimizing long-term functional impairments **(Yang et al., 2025)**. Accordingly, the present study was conducted to assess the prevalence, severity, and risk factors of ICU-acquired weakness in a critical care setting.

The findings of the current study revealed key demographic characteristics of the studied population, regarding age, the average age of the patients was in the early fifties, indicating that ICU-acquired weakness (ICU-AW) affects not only the elderly but also middle-aged adults. This may be attributed to age-related physiological declines in renal, cardiovascular, and neuromuscular functions, which increase vulnerability to critical illness and complications during intensive care. These results are in line with **(Panahi et al., 2020) & (Van Aerde et al., 2020)**, who both reported that ICU-AW commonly affects middle-aged and older adults, highlighting age as a non-modifiable risk factor due to reduced physiological reserves and greater risk of immobilization-related complications.

Regarding marital status, the vast majority of patients were married, reflecting Upper Egypt's high marriage rates. Marital status, as an indirect indicator of social support, may enhance psychological and functional recovery in ICU patients. **(Beil et al., 2022)** and **(Leung et al., 2022)** reported that marital status, reflecting social support, positively influences rehabilitation adherence, mental health, and mortality outcomes in ICU patients, suggesting its indirect role in recovery despite limited direct evidence regarding ICU-AW.

Regarding the ICU setting, more than half of the patients were admitted to general ICUs, the most common ICU type in this study, followed by anesthesia ICUs, with few admitted to trauma ICUs. This distribution reflects admission patterns at Assiut University Hospital, where general ICUs manage a diverse range of critically ill medical, surgical, and septic cases. These findings are consistent with **(Alhazzani et al., 2021) & (Yang et al., 2023),** who reported higher ICU-AW prevalence in general and surgical ICUs due to diverse critical illnesses and prolonged immobilization.

Regarding occupation, the present study found that the majority of patients were employed prior to ICU admission, showing that critical illness affects the working-age population and poses socioeconomic challenges. Physical job demands and comorbidities may contribute, while ICU-acquired muscle weakness can delay return to work. Although ICU-AW is mainly linked to medical factors, occupation may indirectly influence its risk and recovery. **(Kamdar et al., 2020) & (Fuentes-Aspe et al., 2024)**, who reported that physically demanding jobs and occupational frailty negatively impact ICU outcomes, suggesting employment status may indirectly affect ICU-AW risk and recovery.

Regarding educational background, slightly less than half of the patients had completed secondary education, reflecting moderate health literacy. While education is not a direct risk factor for ICU-AW, lower educational levels may impair understanding of care, potentially worsening outcomes. **(Orwelius et al., 2024)** reported no consistent association between education, income, and ICU mortality, but education may still influence ICU-AW severity and recovery through health literacy.

Regarding gender, the current study showed a clear predominance of male patients, comprising nearly three-quarters of the sample, while females represented a smaller portion, reflecting biological susceptibility to severe illnesses like cardiovascular and respiratory diseases, and greater exposure to risk factors such as smoking, alcohol use, and physically demanding jobs that increasing their risk for ICU-AW. This aligns with **(Ma et al., 2022)**, who reported higher ICU admissions among males, driven by greater vulnerability and occupational hazards.

Regarding past medical history, slightly less than half of the patients were diabetic, about one-quarter had thyroid disorders, and just over one-tenth had heart disease. Less than one-fifth reported hypertension, while smaller proportions had renal or hepatic diseases. These findings reveal a significant burden of metabolic and cardiovascular comorbidities among critically ill patients. This finding is consistent with **(Yang et al., 2022)**, who found that conditions like diabetes and chronic kidney disease increase ICU-AW risk. The high rates of diabetes and thyroid disorders likely reflect regional factors and patient complexity, as these conditions contribute to inflammation and muscle breakdown ,key mechanisms in ICU-acquired weakness.

The Percentage Distribution of Studied Patients Related to Mechanical Ventilation Data showed that, nearly half of the patients required ventilatory support. Of those, less than one-fifth were ventilated for three to seven days, while a very small proportion remained ventilated for over a week. This variation reflects the typical range of ventilation needs among critically ill patients, influenced by illness severity and comorbidities. Prolonged ventilation increases the risk of complications such as ICU-acquired weakness and ventilator-associated infections. These findings align with **(Núñez Seisdedos et al., 2022),** who reported that longer mechanical ventilation was significantly associated with ICU-acquired weakness at discharge, reinforcing the link between extended ventilation duration and respiratory and peripheral muscle decline.

Regarding Muscle mass assessment of all upper and lower extremities by using measuring tape, the present study showed no statistically significant changes between the first and seventh days, despite slight decreases in circumference. This could be attributed to early fluid retention, inflammation, and the limited sensitivity of tape measurements. Muscle wasting in ICU-acquired weakness typically develops over longer periods, making one week insufficient to detect changes using this method.

These findings are consistent with **(Lambell et al., 2021) & (Silva-Gutiérrez et al., 2023)**, who emphasized that simple bedside tools like MUAC and MAMC detect only some cases of low muscle mass, recommending more sensitive methods such as ultrasound and extended monitoring for early and accurate detection, especially in patients with prolonged ventilation.

The distribution of the total average MRC (Medical Research Council) muscle strength scores among the studied patients showed that, just over one-third of the patients had a significantly reduced muscle strength score, with scores not exceeding thirty-five points, indicating severe muscular weakness, while nearly half of the patients scored below forty-eight points, indicating a generally suboptimal level of muscle strength. The high prevalence of weakness may result from prolonged immobilization, chronic illness, extended hospital stays, poor nutrition, and medication effects. Thes findings are consistent with **(Fazzini et al., 2023)**, who reported that nearly half of critically ill patients develop ICU-acquired weakness.

Regarding the distribution of risk factors among the studied patients, a variety of clinical, demographic, and therapeutic variables were identified as potential contributors to ICU-acquired muscle weakness. Notably, older age and female gender were prevalent, both associated with greater susceptibility to muscle deterioration during critical illness. Among comorbidities, **diabetes** was particularly common, underscoring the role of impaired glucose metabolism in muscle decline. **Obesity & smoking** were also observed in a significant portion, while **hypertension** and **sepsis** were less frequent but clinically relevant due to their links with inflammation and muscle breakdown.

Mechanical and metabolic stressors were prominent. A large proportion of patients experienced prolonged mechanical ventilation and extended ICU stays**,** both known to promote muscle atrophy. Nearly half of the patients also had **elevated lactic acid levels**, indicating metabolic stress.

Concerning nutritional and metabolic factors, disturbances were also evident. Hyperglycemia was reported in a modest portion of the patients, while malnutrition affected a substantial number. Of **particular significance** is that, all of the patients were immobilized during their ICU stay, reinforcing its central role in ICU-acquired weakness (ICU-AW). **Therapeutically**, the vast majority of patients received sedatives, and a large proportion also received neuromuscular blockers, vasoactive drugs and corticosteroids treatments that, while essential, may contribute to neuromuscular complications.

These findings align with **(Li et al., 2024)** and **(Mostafa & Rabea, 2023)**, who identified smoking, male sex, prolonged ICU stay, vasoactive drugs, aging, chronic illness, malnutrition, immobilization, elevated lactate, and pharmacologic exposures as key risk factors for ICU-acquired weakness.

Regarding Percentages of Patients' APACHE Score among the Studied Patients, it was revealed that a significant distribution within the moderate severity range. A considerable portion of patients were found to have scores falling between ten and fourteen, indicating a manageable level of illness with appropriate medical care. Additionally, a smaller, yet still significant group scored within the fifteen to nineteen range, reflecting a more serious clinical condition and a higher risk of complications. This result may be attributed to the Early ICU admission likely prevented progression to severe illness, resulting in these moderate scores. Despite this, patients remain at risk of ICU-acquired weakness due to factors like prolonged immobilization and systemic inflammation. The findings align with **(Li et al., 2021) & (Mumtaz et al., 2023)**, who reported that moderate APACHE II scores (11–20) as an independent risk factor for ICU-AW, with many patients achieving favorable outcomes.

Regarding the Relation Between Demographic Data of Studied Patients and MRC Muscle Strength Scale, the study revealed a statistically significant association between age, sex, and muscle strength measured by the MRC scale. These findings suggest that demographic factors play a notable role in determining muscle strength among ICU patients. Physiologically, muscle strength typically declines with age due to muscle fiber loss and reduced regeneration, while males generally have greater strength due to higher testosterone levels and often higher physical activity. These demographic factors are important when assessing muscle strength and tailoring rehabilitation, as responses may vary. The present findings align with **(Khalil et al., 2023),** who also reported that older age and male sex are significantly associated with ICU-acquired muscle weakness.

Regarding the relation Between The Studied Patients' Clinical Data and the MRC Muscle Strength Scale, the current study indicates statistically significant associations between clinical factors and MRC muscle strength scores. Prolonged mechanical ventilation was linked to greater muscle weakness, as reflected by lower MRC scores. Additionally, a significant relationship was observed between patients past medical history and their MRC scores, suggesting that comorbidities such as diabetes, hypertension, thyroid dysfunction, and renal, hepatic, or cardiac diseases were associated with reduced muscle strength. These findings emphasize the impact of chronic illnesses and clinical interventions, including immobility and inflammation, on ICU-acquired weakness. This aligns with **((Lu & Wenjuan, 2024)** and **(Yamada et al., 2023)**, who identified prolonged mechanical ventilation and comorbidities as key predictors of ICU-AW and functional decline.

Concerning the relation between the total average MRC (Medical Research Council) score and various risk factors among the studied patients, the findings revealed statistically significant associations with several variables, including advanced age, hypertension, diabetes, prolonged mechanical ventilation, extended ICU stay, hyperglycemia, malnutrition, immobilization, and the use of certain medications. Among these, the most significant contributors to reduced muscle strength were prolonged MV, hyperglycemia, and malnutrition, all of which were linked to lower MRC scores, indicating greater muscle weakness. These factors impair muscle metabolism, circulation, and repair, while immobility causes disuse atrophy. Chronic illnesses and ICU medications like corticosteroids further worsen muscle breakdown. The results are consistent with **(Zhang et al., 2025)**, who reported similar risk factors as strong predictors of ICU-acquired weakness (ICU-AW).

Regarding the Relation Between Total APACHE Score of Studied Patients and Total Average MRC Score, the current study revealed a statistically significant association between higher APACHE II scores and lower muscle strength measured by the MRC scale. Greater illness severity, indicated by elevated APACHE scores, is linked to increased risk of ICU-acquired weakness due to factors like prolonged immobilization, corticosteroid or neuromuscular blocker use, systemic inflammation, and extended mechanical ventilation. These contribute to muscle atrophy and neuromuscular dysfunction. This is consistent with the study by **(Lei et al., 2025)**, who reported that higher APACHE II scores predicted early-onset ICU-AW in septic patients.

Conclusion:

Intensive Care Unit-Acquired Weakness (ICU-AW) is a significant and prevalent complication among critically ill patients, as demonstrated in this study conducted at Assiut University Hospital. The findings revealed that 45% of the studied patients developed ICU-AW, with 35% experiencing severe muscle weakness, indicating notable variability in severity. This condition was significantly associated with prolonged mechanical ventilation, extended ICU stay, sepsis, diabetes, immobility, malnutrition, and the use of certain medications. Patients affected by ICU-AW exhibited longer recovery periods and poorer functional outcomes.

Recommendations:

- Enhance nursing staff training on early detection and assessment of ICU-AW using standardized tools.
- Implement early mobilization protocols in ICUs to reduce immobility-related complications and promote muscle preservation
- Monitor high-risk patients closely, such as those with diabetes, sepsis, or prolonged ICU stays, and tailor preventive strategies accordingly.
- Review and optimize the use of medications that may contribute to ICU-AW.
- Conduct further multicenter research to guide ICU-AW prevention strategies.
- Raise awareness among critical care teams about the ICU-AW risks.

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