Clinical Trial

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Effect of vitamin D as Nutrition Supplement on Patients with Prolonged Ventilation due to Ventilator Associated Pneumonia and Sepsis Followed Severe Traumatic Lung Contusion: A Randomized Controlled Trial

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Abstract

Background. Recent studies have shown that vitamin D deficiency is highly prevalent among critically ill patients, with reported rates ranging from 40% to 80% in ICU cohorts. Its deficiency associated with increased risk for respiratory infections, prolonged ventilation and increased length of stay, and mortality.

Objective. The primary objective was to evaluate the effect of high-dose vitamin D supplementation on recovery from severe traumatic lung contusion, VAP, and sepsis. The secondary objectives were to assess its impact on duration of mechanical ventilation, length of ICU stay, and mortality.

Methods. This prospective, double-blinded randomized controlled trial included 80 adult ICU patients with severe traumatic lung contusion who remained mechanically ventilated for 10 consecutive days and subsequently developed VAP and sepsis (Murray score >4, CPIS >6, SOFA score >10, excluding GCS). Patients were randomized to receive either standard enteral nutrition (Group A, n=40) or standard nutrition plus high-dose vitamin D (cholecalciferol 100,000 IU/day for 14 days) (Group B, n=40). Clinical outcomes were assessed over a 14-day follow-up period.

Results. Compared with Group A, patients in Group B demonstrated significantly faster recovery from lung contusion, VAP, and sepsis, reflected by lower Murray, CPIS, and SOFA scores at both week 1 and week 2 ($p<0.05$). Group B also showed significantly shorter durations of mechanical ventilation and ICU stay ($p<0.001$) and a lower mortality rate (10.0% vs. 27.5%, $p=0.045$)

Conclusion. This study clarifies the effect of vitamin D in controlling all clinical manifestation of severe traumatic lung contusion, controlling all clinical manifestation of VAP, controlling all clinical manifestation of sepsis, accelerate weaning from ventilation, shorten the duration of ICU stay and decreasing the mortality rate of those patients who had sever traumatic lung contusion and ventilated for ten days, then complicated by VAP and sepsis as complications from prolonged ventilation. ***Clin Ter 2026; 177 (1):65-73 doi: 10.7417/CT.2026.1976***

Keywords: *vitamin D, Nutrition, VAP, Sepsis, Lung, Contusion*

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Introduction

Severe traumatic lung contusion is a life-threatening condition it is always associated with prolonged mechanical ventilation which remains a significant challenge in critical care, often associated with increased morbidity, longer intensive care unit (ICU) stays, and higher healthcare costs. Patients requiring extended ventilatory support are particularly vulnerable to complications such as ventilator-associated pneumonia (VAP), muscle wasting, impaired weaning, and multi-organ dysfunction. Identifying modifiable factors that influence outcomes in this population is a pressing clinical priority. (1)

Vitamin D, traditionally known for its role in calcium and bone metabolism, has emerged as a pleiotropic hormone with wide-ranging effects on immune regulation, inflammation, and muscle function. In critically ill patients, vitamin D deficiency is highly prevalent, with reported rates ranging from 40% to 80% in ICU cohorts. Driven by limited sun exposure, poor nutritional intake, altered metabolism, and systemic inflammation. Emerging evidence suggests that suboptimal vitamin D levels may exacerbate critical illness through impaired immune defenses, increased susceptibility to infections, dysregulated inflammation, and respiratory muscle weakness. (2)

In the context of prolonged mechanical ventilation, these mechanisms are particularly relevant. Vitamin D's role in modulating innate and adaptive immunity, preserving endothelial integrity, and enhancing muscular function may influence both the duration of ventilatory support and the likelihood of successful weaning. However, despite the biological plausibility, the clinical significance of vitamin D status in this high-risk subgroup remains under explored. vitamin D supports endothelial integrity and respiratory muscle function, which may facilitate recovery from lung injury and improve ventilator weaning. These mechanisms provide a strong biological rationale for investigating vitamin D supplementation in patients with severe traumatic lung contusion complicated by VAP and sepsis. (3)

The Murray Lung Injury Score is a validated tool for assessing the severity and progression of acute lung injury based on oxygenation, radiographic findings, PEEP, and lung compliance. It was selected to objectively monitor pulmonary recovery in patients with severe traumatic lung contusion. The Clinical Pulmonary Infection Score (CPIS) is widely used for diagnosing and monitoring ventilator-associated pneumonia (VAP) and incorporates clinical, radiological, and microbiological parameters. The Sequential Organ Failure Assessment (SOFA) score evaluates systemic organ dysfunction in sepsis. In this study, SOFA was calculated excluding the Glasgow Coma Scale to reduce confounding from trauma-related or sedation-induced neurological impairment. Together, these scores provide a comprehensive assessment of pulmonary injury, infectious complications, and systemic severity. (1)

Objective

Study Design and Setting: This prospective, double-blinded, randomized controlled study was conducted in the Anesthesia, Intensive Care, and Pain Management Department at Al-Azhar University Hospitals. Ethical approval was obtained from the Institutional Review Board, (IRB 462/2025).

Study Population: Patients with severe traumatic lung contusion admitted to the surgical ICU were initially screened and diagnosed based on clinical examination, chest X-ray, and confirmation by chest CT, with a Murray score >4. The first inclusion criterion was mechanical ventilation for 10 consecutive days. From this population, 80 patients meeting the second inclusion criteria—Murray score >4, CPIS >6, and SOFA score >10 (excluding GCS)—were enrolled. Additional inclusion criteria were age 21–65 years, patient or relative consent, and both sexes.

Exclusion criteria included: Any patient with chronic chest disease chronic obstructive lung disease (COPD), bronchial asthma and interstitial lung fibrosis.

- Patients with chronic advanced lung, hepatic, renal and/or cardiovascular disease.
- Patients with a history of cardiac arrest or anoxic brain injury.
- Terminal advanced malignancy.

Randomization and blinding: Patients were randomized into two groups (n=40 each). Neither the medical team, nurses and/ or nutrition team nor the data collection team was aware of the treatment allocation only the members of the research team were aware about the treatment.

Intervention:

- Group A (Control): Standard NGT feeding according to our hospital policy mentioned below.
- Group B (Vitamin D Group): Standard NGT feeding and vitamin D supplementation through the NGT by the dose and duration mentioned below.

Material and Methods:

Sample Size Calculation

The sample size was calculated to detect a clinically meaningful difference in recovery from severe lung contusion, VAP, and sepsis between groups. Based on hospital ICU records, the incidence of prolonged mechanical ventilation with VAP and sepsis among patients with severe traumatic lung contusion was approximately 35–40%. Using a significance level of 0.05, 90% power, and an expected effect size of 0.6 for primary outcomes (Murray, CPIS, SOFA scores), the minimum sample size required was 80 patients (40 per group).

Ethical Considerations and Informed Consent

The study was approved by the Institutional Review Board (IRB 462/2025). Written informed consent was obtained from all patients or their first-degree relatives before enrollment, in accordance with ethical guidelines for research involving critically ill patients.

Observation Time Points and Outcome Measures

Patients were monitored for 14 days following enrollment. Outcome measures were recorded at baseline (T0), at week 1 (T1), and week 2 (T2):

Primary outcomes:
- Murray score (lung injury severity)
- CPIS (ventilator-associated pneumonia)
- SOFA score excluding GCS (sepsis-related organ dysfunction)

Secondary outcomes:
- Duration of mechanical ventilation
- ICU length of stay
- Morbidity and mortality
- Delta changes (ΔT0–T1, ΔT1–T2, ΔT0–T2) were calculated to assess improvement over time.

Vitamin D Intervention and Rationale

Patients in the intervention group received 100,000 IU/day of cholecalciferol via NGT for 14 days. This high-dose regimen was selected based on previous ICU studies showing rapid immunomodulatory and anti-inflammatory effects of vitamin D within one week, without significant toxicity in short-term use. The risk-benefit profile was considered favorable, as high-dose vitamin D can improve immune function, reduce inflammation, enhance respiratory muscle strength, and potentially decrease ventilation duration, ICU stay, and mortality. Patients were monitored for hypercalcemia or other adverse events during the study.

Statistical analysis

Was performed using SPSS software (version 20). Continuous variables with normal distributions were expressed as mean ± standard deviation (SD), while categorical variables were summarized as numbers and percentages. Statistical analysis was performed using the chi-square test for categorical data as Gag reflex and Complicated related while comparing the numeric variables as age, weight, pulse, blood pressure and recovery time was done using independent t-test. Comparison of the ordinal variables as VAS score and satisfaction level was made using Mann Whitney U test. P-values less than 0.05 were considered statistically significant, and those less than 0.001 were considered highly statistically significant. The data was expressed as mean and standard deviation. The categorical variables were carried out using the Chi-square test. The interval variables between the two groups such as NRS were compared using the independent t-test. Due to the relatively limited sample size and the focused nature of the study population, advanced multivariate regression and survival analyses were not performed. The primary objective was to compare clinically relevant outcomes between randomized groups under controlled conditions. While randomization reduced baseline confounding, the study was not powered to support complex multivariable modeling. Therefore, findings are reported as statistically significant associations rather than causal effects. Larger multicenter trials are required to confirm these observations and allow for robust multivariate and survival analyses.

CONSORT Requirement: Participant Flow Diagram

According to the CONSORT statement (4) a graph describing all participants from the screening and recruitment phases through to the final analysis, including those who were randomized, received the intervention, were lost to follow-up, or were excluded. Figure 1

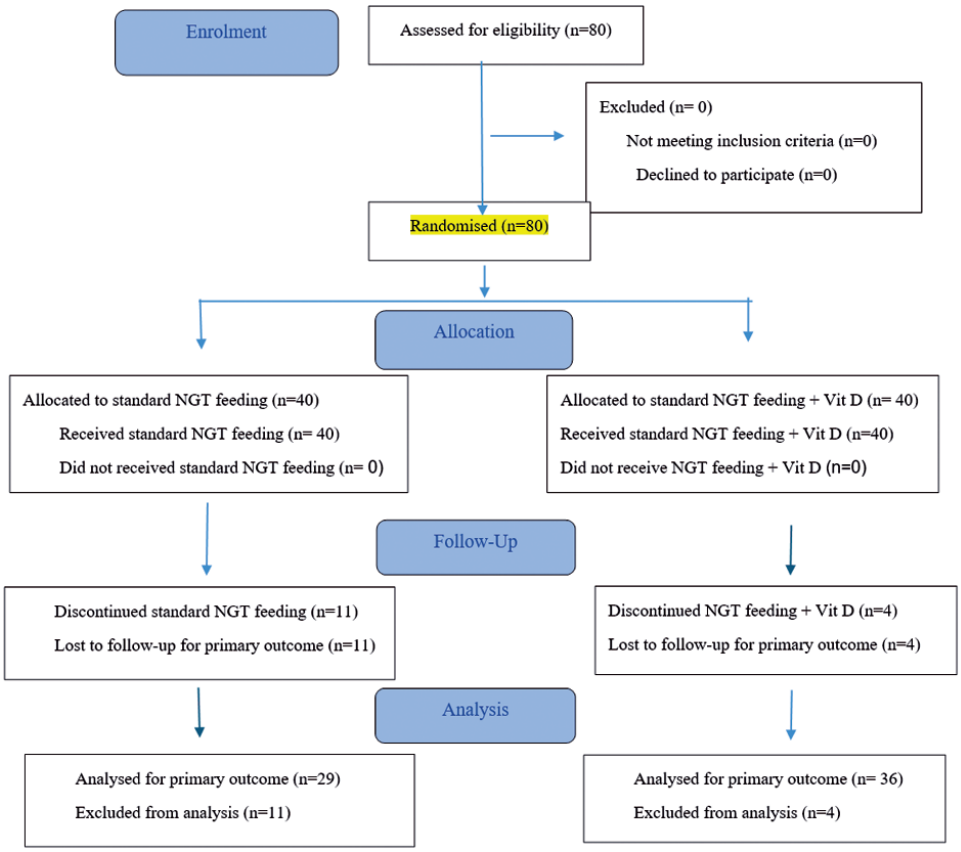

Figure 1. A graph describing the flow-chart of the study starting from the randomization process according to the CONSORT statement.

I. All Cases Underwent:

a. patient Examination and investigation:

All patients were hospitalized and admitted to surgical ICU, full history with physical examination including GCS and routine investigations (complete blood count (CBC), Coagulation profile, sepsis screen, liver and kidney function testes) and Vital data monitoring including core temperature were done daily. All radiological study (X-ray, CT) and all consultations needed (as surgical, neurosurgical, orthopedic or cardiothoracic consultations) were done. Resuscitation was done if needed according to our hospital policy and including blood, blood products and fluid. Our end point of resuscitation was (Mean arterial blood pressure ≥ 90 mmHg, Hemoglobin (Hb) ≥ 10 gm %, urine output (UOP) was 0.5 ml /kg /hour, platelets ≥ 100.000 cm^3, INR ≤ 1.5, PT ≤14 second and PTT ≤ 45 second). Only patients with severe traumatic lung contusion diagnosed by clinical examination, chest X ray and confirmed by chest high- resolution computed tomography (HRCT) and had Murray score ≥ 4 were enrolled (considered first inclusions criteria). All patients connected to controlled mechanical ventilation (CMV) for ten days with a respiratory rate of 12/min, a minimum positive end-expiratory pressure (PEEP) was used to maintain arterial oxygen saturation (SPO2) ≥ 90%, and a minimum fraction of inspired oxygen (FIO2) was used to maintain SPO2 ≥ 90%. An arterial and central line were established for all patients in our surgical ICU. A sedative, including fentanyl and midazolam intravenous infusion was used, to achieve a Richmond Agitation-Sedation Scale (RASS) score of -2–-3 (5). In addition, all patients were administered broad-spectrum antibiotics in the form of 1 gm cefepime (Maxipime) via slow intravenous infusion at eight-hour intervals according to our hospital policy. Subsequent to three days of ventilation, a qualitative sputum, blood and urine culture were obtained from all patients, and the antibiotic regimen was adjusted in accordance with the culture results. This group of culture repeated every week according to our infectious disease department protocol. On the second day of ventilation, enteral feeding was initiated using a feeding pump after a written approval from surgical team. The feeding rate was established at 70 mL of Ensure plus (Abbot) with a caloric density of 1.47 kcal/mL, designed to provide patients with an estimated 2500 kcal within 24 hours, based on an approximation of 35 kcal/kg (6). Furthermore, all patients underwent percutaneous tracheostomy on the 7th day of ventilation. To prevent VAP, a five-point bundle was implemented on all patients. This included raising the head of the bed by 30º to 45º, conducting a daily assessment for potential extubation, unitizing an endotracheal tube with subglottic secretion drainage, administering oral care with oral antiseptics, and initiating safe enteral nutrition within 24–48 hours of admission to the ICU and ventilation. After 10 days from ventilation only 80 patients were enrolled in our study (considered secondary inclusion criteria), those who had Murray score ≥ 4 days, CPIS score ≥ 6 and SOFA ≥ 10 (GCS excluded from the score).

In our study we exclude the GCS from SOFA score to decrease biases.

Patients of group B given daily vitamin D 100.000 IU cholecalciferol through NGT / day for 14 consecutive days. The duration of the study was 14 days. And data of Murray score, CPIS score and SOFA score represented every seven days. Any patient not fulfilling criteria of weaning after studied period considered morbidity. Both morbidity and mortality recorded and compared.

d. Method of sample collection:

Patients were randomly allocated by a computer - generated table into two groups, each group of (40 patients). For all patients in both groups a daily routine investigation done according to protocol of our hospital mentioned in details before and blood, sputum and urine cultures done according to specific regimen mentioned before for all patients Murray score, CPIS score and SOFA score were calculated every week.

Control group (group A) (n= 40): Received standard NGT feeding according to our hospital policy mentioned above.

Vitamin D group (group B) (n= 40): Received standard NGT feeding and vitamin D supplementation through the NGT by the dose and duration mentioned above.

Withdrawal Criteria: patients have the right to withdraw from the study at any time either by himself or by his 1st degree relative without any negative consequence on their medical treatment plan.

II. Operational design:

Patients selected from Al-Azhar University Hospitals who admitted to ICU with severe traumatic lung contusion and ventilated for long time (10 days) then enrolled 80 patients from them who had Murray score ≥ 4, CPIS score ≥ 6 and SOFA score of ≥ 10 (GCS excluded from the score). (7-11) Outcome assessor (physician not sharing in the study) monitored the patients for all primary and secondary outcomes. All Patients followed for 14 days.

III. Clinical Data monitored and methods of its presentation:

Data of the primary outcome include Murray score, CPIS score and SOFA score (table (1)) recorded for all patients in both groups every 7 days presented in tables numerically and by percent. The secondary outcome data includes morbidity, mortality, and number of patients discharged from the ICU presented once by the same way mentioned before but at the end of the studied period.

Results:

Patients admitted to ICU with severe traumatic lung contusion and ventilated for long time (10 days) then enrolled 80 patients from them who had Murray score ≥ 4, CPIS score ≥ 6 and SOFA score of ≥ 10.

Patient Characteristics: There were no statistically significant differences between groups in terms of baseline demographic and clinical characteristics.

Primary Outcome:

- A significantly higher percentage of patients in Group B who showed shorter duration of healing from traumatic lung contusion, shorter duration to recover from VAP and recover from sepsis.

Table 1. Primary outcome data (Murray score, CPIS, and SOFA score without GCS) (8-11).

Clinical parameter of Murray score	**0**	**1**	**2**	**3**	**4**
Hypoxic index PaO_2/FIO_2	≥ 300	299-225	224-175	174-100	<100
Chest X-ray	Non	1quadrant infiltrated	2quadrants infiltrated	3quadrants infiltrated	4quadrants infiltrated
PEEP	≤ 5	6-8	9-11	12-14	≥ 15
Compliance ml /1 cm H_2O	≥ 80	79-60	59- 40	39-20	≤ 19

CPIS score	**0**	**1**	**2**
Tracheal secretion	Rare	Abundant	Abundant & purulent
Chest X-ray infiltrate	No infiltrate	Diffuse	Localized
Temperature °C	> 36.5 and < 38.4	> 38.5 and < 38.9	> 39 or < 36
Leucocytic count per mm^3	> 4000and < 11000	< 4000 or > 11000	< 4000 or > 11000 +band form > 500
Hypoxic index PaO_2/FIO_2 mmHg	>240 or ARDS	-	< 240 and no evidence of ARDS
Microbiology	Negative	-	Positive

SOFA score without GCS	**0**	**1**	**2**	**3**	**4**
Respiration: PaO_2/FIO_2 (mm Hg)	normal	<400	<300	<220	<100
Coagulation profile: Platelets count in $10^3/mm^3$	normal	<150	<100	<50	<20
Liver: Bilirubin (mg/dL)	normal	1.2-1.9	2.0-5.9	6.0-11.9	>12.0
Cardiovascular: Hypotension	normal	MAP <70	Dopamine ≤5 or dobutamine (any)	Dopamine >5 or norepinephrine ≤0.1	Dopamine >15 or norepinephrine >0.1
Renal: Creatinine (mg/dL) or urine output (UOP) (mL/day)	normal	1.2-1.9	2.0-3.4	3.5-4.9 or UOP<500	>5.0 or UOP <200

Secondary Outcome:

- Group B had a significantly higher percentage of patients exhibit shorter duration of ventilation and ICU stay. with less morbidity and mortality rate at the end of the studied period.

One patient from group B died on the 5th days of the studied period while 5 patients died from group A on the 4th and 6th day respectively of the studied period. Another 2 patients died from group B on the 8th and 9th day respectively while 3 patients died from group A on 8th, 10th day respectively of the studied period. Total mortality rate presented numerically and by percent in table (5) and it was 4 cases from group B and 11 cases from group A at the end of the studied period. represented in table (5)

Table (2) shows the demographic data of the studied patients' groups.

Table (3) shows Primary outcome data recorded at the end of the first week (Murray score, CPIS, and SOFA score without GCS).

Table 2

	Group A (n=40)		**Group B (n=40)**		**P value**
Age Group	**No**	**%**	**NO**	**%**	
≥ 21 - <45 years	23	57.5%	24	60%	0.82
45 - <65 years	17	42.5%	16	40%	
Sex					
Male	28	70%	29	72.5%	0.80
Female	12	30%	11	27.5%	

Table 3

	Group A (n=35)		Group B (n=39)		P value
Murray score	**No**	**%**	**No**	**%**	
0	10	28.57%	20	51.28%	0.025
1- <4	10	28.57%	13	33.33%	
>4	15	42.85%	6	15.38%	
CPIS score	No	%	No	%	
0	11	31.42%	19	48.71%	0.155
1- <6	10	28.57%	12	30.77%	
>6	14	40.00%	8	20.51%	
SOFA score	No	%	No	%	
0	12	34.28	19	48.71%	0.24
1- <10	11	31.42%	13	33.33%	
>10	12	34.28	7	17.95%	

Table (4) shows Primary outcome data recorded at the end of the second week (Murray score, CPIS, and SOFA score without GCS)

Table (5) shows number of patients weaned, discharged from ICU and those had morbidity, mortality at the end of the studied period

Table 4

	Group A (n=32)		Group B (n=37)		P value
Murray score	**NO**	**%**	**NO**	**%**	
0	13	40.63%	29	78.38%	0.004
1-<4	10	31.25%	6	16.22%	
>4	9	28.13%	2	5.41%	
CPIS score	NO	%	NO	%	
0	11	34.38%	31	83.78%	<0.001
1-<6	11	34.38%	4	10.81%	
>6	10	31.25%	2	5.41%	
SOFA score	NO	%	NO	%	
0	14	43.75	30	81.08%	0.003
1-<10	10	31.25%	6	16.22%	
>10	8	25.00%	1	2.70%	

Table 5

	Group A (n=29)		Group B (n=36)		P value
	No	**%**	**No**	**%**	
Number of weaned	12out of 29	41.38%	31out of 36	86.11%	<0.001
Number of discharged	10 out of 29	43.48%	28 out of 36	77.77%	<0.001
Patients had morbidity	17 out of 29	58.62%	5 out of 36	13.88%	<0.001
Total number died	11 out of 40	27.50%	4 out of 40	10.00%	0.045

Discussion

Duration of the study was 2 weeks, this duration decided by our research and community department of our hospital as in our hospital any surgical case ventilated more than 2 weeks considered morbidity and also decided by our researcher team after reviewing the previous studies. While clinical data of Murray score, CPIS score and SOFA score of all patients in both groups represented every seven days, decided by reviewing literature about onset of action of high dose of vitamin D and most of the literature had agreement that high dose of vitamin D start its effect after seven days. (12-15) There were two groups of inclusion criteria of this study the first group was severe lung contusion which diagnosed by clinical examination, chest X ray and confirmed by chest HRCT and had Murray score ≥ 4 enrolled and ventilated for ten consecutive days. From those, 80 patients selected who still had Murray score ≥ 4, CPIS score ≥ 6 and SOFA score of ≥ 10 and followed for two weeks by the same score.

Murray score used to assess healing from severe lung contusion, CPIS used to assess the healing from VAP and SOFA score used to assess improvement of systemic parameters of sepsis. All those scores reviewed and accepted by our infection control department.

SOFA score used in our study without monitoring GCS as the researcher team found that it increases the biases. Because conscious level may be deteriorated either directly from the trauma (head trauma) or indirectly from global stat of hypoxemia (severe lung trauma) and toxemia (from sepsis). By exclusion of GCS from SOFA score the infectious disease team in our hospital consulted to adjust the SOFA score to be reliable for severe sepsis in this study and they agree on score ≥ 10.

Number of patients decided by reviewing our hospital annual statistics and number of cases admitted with severe traumatic lung contusion and annual number of patients who developed VAP, Sepsis and/or septic shock from prolonged ventilation (annual data was taken from infectious disease department). Long term ventilation in our study given to any patient ventilated for ten consecutive days without fulfilling criteria of weaning while morbidity term given to any patient not fulfilling weaning criteria at the end of the studied period, and both durations discussed and agreed by researcher team after reviewing annual data of duration of ventilation in our surgical ICU and reviewing annual results of sputum culture of ventilated patients from infection control department putting in mind our hospital routine sputum culture mentioned before. In this study we used the CPIS score for detection of VAP as indicator for local complication of severe contused lung injury, and we used SOFA score without GCS as indicator to detect severe sepsis and /or septic shock as indicator for systemic complication of both lung contusion and VAP.

There was no any significant difference between the demographic data of the patients allocated in both groups. In our study we found that incidence of severe traumatic lung contusion is more common between male than female, this could be explained by our social rules.

This study demonstrates that administration of vitamin D is an effective method for controlling clinical manifestation of severe lung contusion, controlling all clinical manifestation of VAP, controlling all clinical manifestation of sepsis, accelerate weaning from ventilation, shorten the duration of ICU stay and decreasing the mortality rate of those patients who had sever traumatic lung contusion and ventilated for ten days, then complicated by VAP and sepsis as complications from prolonged ventilation this might be due to its unique pharmacological actions as:

Immune Modulation and Infection Control, vitamin D exerts a significant influence on both the innate and adaptive immune responses. It enhances the production of antimicrobial peptides such as cathelicidins and defensins, which play critical roles in mucosal defense and pathogen clearance. Vitamin D also modulates the activity of monocytes and macrophages, facilitating phagocytosis while downregulating excessive pro-inflammatory responses. In adaptive immunity, it suppresses T helper1 and T helper17 cell responses and promotes regulatory T cell (Treg) function, creating a balanced immune environment (16-18)

Inflammatory Response and Organ Dysfunction, Vitamin D plays a crucial role in attenuating the systemic inflammatory response that characterizes many critical illnesses, including sepsis, acute respiratory distress syndrome (ARDS), and multi-organ dysfunction syndrome (MODS). It achieves this by inhibiting pro-inflammatory cytokines such as TNF-α, IL-1β, and IL-6, while enhancing anti-inflammatory cytokines like IL-10. In the setting of sepsis and severe lung contusion a dysregulated immune response can lead to endothelial dysfunction, capillary leak, and tissue damage. Vitamin D's protective effects on endothelial barrier integrity and vascular function may help reduce the severity of organ dysfunction. Experimental studies have shown that vitamin D supplementation can mitigate lung injury and improve alveolar-capillary membrane integrity in animal models, suggesting potential benefits in preventing or ameliorating ARDS in humans. (19-20)

Muscular Function and Weaning from Ventilation, another critical aspect of vitamin D in ICU care is its influence on muscular function, particularly in relation to respiratory muscles. Vitamin D deficiency has been associated with muscle weakness and atrophy, both of which are significant contributors to prolonged mechanical ventilation and difficulty in weaning. Given that successful liberation from mechanical ventilation depends on the integrity of the diaphragm and other respiratory muscles, adequate vitamin D levels may play a supportive role in improving weaning outcomes. (21)

Cardiovascular and Metabolic Implications Vitamin D is also involved in cardiovascular regulation as it modulates myocardial contractility, and regulates vascular tone. These effects may be beneficial in patients with septic shock or hemodynamic instability either due to trauma or due to septicemia and toxemia. Moreover, vitamin D has been implicated in glycemic control and insulin sensitivity, factors that can influence outcomes in critically ill patients with stress hyperglycemia or diabetes. As controlling hyperglycemia is very important in critical patients. Hyperglycemia inhibit phagocytic function of macrophage and invite infection especially in devitalized lung tissue due to severe lung contusion. (22)

The result of our study support several observational studies which have linked vitamin D deficiency with in-

creased ICU and hospital mortality, longer lengths of stay, and higher risk of adverse outcomes we found the same facts as regard improvement of all primary and secondary outcome parameters measured, (13-22) but there is very important clinical point that differs our study from others as we don't use vitamin D as replacement therapy we use it as a steroid hormone regardless level of vitamin D in our patients, we ignore serum level of vitamin D in our patients, we did not follow any clinical signs of low vitamin D and we don't send or follow any serum level of vitamin D. this means that our result represents effect of vitamin D as a hormone used to regulate previous mentioned body functions.

A 2014 meta-analysis suggested that low vitamin D levels were independently associated with a nearly twofold increase in mortality among critically ill patients. (22-24) Another meta-analysis done and authors retrieved 25 eligible trials, including 8128 participants. Four trials compared the preventive effects of vitamin D supplementation on SARS-CoV-2 infection, and the results were inconclusive. Regarding the treatment of SARS-CoV-2 infection with vitamin D supplementation, it was found that vitamin D supplementation could significantly reduce the rates of ICU admission and mechanical ventilation, but had no statistically significant effect on mortality. However, in subgroup analyses based on the patients' specific conditions, vitamin D supplementation significantly reduced the mortality in patients with vitamin D deficiency. (25-26)

On the other hand, a meta-analysis done in 2017which studied Six randomized clinical trial enrolled 695 critical ill patients admitted in surgical ICU and showed that vitamin D administration does not improve clinical outcomes, as regard length of hospital stay, infection rate and duration of ventilation. The statistical imprecision could be explained by the sparse number of trials. (27)

However, discrepancies exist regarding effect of vitamin D on mortality rates we found significant reduction in both morbidity and mortality rates between patients of group B.

Clinical Implications

Most of literature prove the effect of vitamin D on decreasing the duration of ventilation, improving the outcomes in critical ill patients as regards infection rate, overcome sepsis and rapid weaning from both inotropes and ventilation, Additionally, its role in in epidemics of SARS-CoV-2 infection documented by many studies as it reduces the rate of ICU admission. (28-32). But still future guidelines should focus on refining indications, dosing, duration and best method of administration and developing protocols for targeted administration to ensure cost-effectiveness without compromising patient outcomes.

Limitations and Future Directions

Despite its strengths, this study has several limitations. First, the sample size was relatively small, which may limit the generalizability of our findings. Second, we chose only severe traumatic lung contusion and only those who had prolonged ventilation and complicated by VAP and severe sepsis and/or septic shock. Third, the study design did not allow for direct comparison between different methods of administration of vitamin D as we used only the oral form of vitamin D through the naso-gastric tube.

In conclusion future research should focus on randomized controlled trials with larger cohorts to better define the risk-benefit profile of vitamin D. Additionally, exploring the role of different methods of administration of vitamin D and comparing the efficacy of each method with the others may further enhance its efficacy and safety.

Conclusion

Vitamin D is an effective and efficient option in controlling all clinical manifestation of severe traumatic lung contusion, controlling all clinical manifestation of VAP, controlling all clinical manifestation of sepsis, accelerate weaning from ventilation, shorten the duration of ICU stay and decreasing the mortality rate of those patients who had sever traumatic lung contusion and ventilated for ten days, then complicated by VAP and sepsis as complications from prolonged ventilation. While our study supports its clinical utility, careful patient selection and further research into individualized dosing, duration, best method of administration and long-term outcomes are warranted to optimize its use.

Decelerations and statements

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Ethics approval and consent to participate. The study protocol was reviewed and approved by the Institutional Review Board (IRB)/Ethics Committee of faculty of medicine, Al Azhar University (Approval No. 462/2025).

Availability of data and materials. The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests. The authors declare no competing interests.

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