Journal of Rural Medicine

Original article

An analysis of patients with a chief complaint of difficulty moving

Kenichi Muramatsu[1], Hiroki Nagasawa[1], Ikuto Takeuchi[1], Kei Jitsuiki[1], Hiromichi Ohsaka[1], Kouhei Ishikawa[1], and Youichi Yanagawa[1]

[1]*Department of Acute Critical Care Medicine, Shizuoka Hospital, Juntendo University, Japan*

Abstract

Objective: There have been few reports in English medical journals analyzing patients with difficulty moving. Herein, we conducted a retrospective survey of emergency patients admitted to our hospital with the chief complaint of difficulty moving, to clarify the clinical characteristics of the frequency, causative disease, and outcome in these patients.

Patients and Methods: Between August 2017 and October 2021, we surveyed the patient database maintained by our department, covering cases in which the main complaint at the time of patient transport by ambulance to our hospital was difficulty moving.

Results: In 111 cases, the patient's primary complaint was difficulty moving or adynamia. Patients included 59 males and 52 females, with a mean age of 76.3 years old. The most frequent diagnosis in these patients was rhabdomyolysis, followed by infection, body temperature abnormalities, electrolyte disorder, blood glucose abnormality, hypoxia, and renal failure. Trauma and various other diseases, such as stroke and malignancy, were also found to be causative diseases. After discharge from the hospital, the number of patients with a dependent status was greater than those with an independent status.

Conclusion: Patients with difficulty moving were primarily elderly, and had a variety of causative diseases. Therefore, multiple approaches are required to manage these patients.

(J Rural Med 2023; 18(1): 36–41)

Introduction

Clinicians working in the emergency room often encounter patients with the chief complaint of difficulty moving. Muscular and skeletal muscle disorders, pain, and neurological abnormalities have previously been described as factors contributing to difficulty moving[1, 2]. A literature search using the search terms "moving/movement", "difficulty", and "body" in PubMed did not reveal any reports on difficulty moving from the perspective of emergency patients.

Our hospital, located in the eastern part of Shizuoka Prefecture, has an emergency center and is also a base for emergency helicopters in the same region. Approximately 6,000 emergency patients are received by ambulance or physician-staffed helicopters per year, covering a population of approximately 1,100,000 people.

Herein, we conducted a retrospective survey of emergency patients brought to our hospital with the chief complaint of difficulty moving, and clarified the clinical characteristics associated with frequency, causative disease, and outcome.

Patients and Methods

This study was approved by the Ethics Committee of the Juntendo Shizuoka Hospital under the approval number 298. We conducted a survey of the patient database maintained by our department, for which we selected patients with the main complaint of difficulty moving or adynamia, as determined by emergency medical technicians (EMTs) from August 2017 to October 2021. A retrospective medical chart review was conducted using the following information: sex, age, medical history (hypertension, diabetes, dementia), independence in activities of daily living (ADL), vital signs (Glasgow Coma Scale, systolic blood pressure, heart rate, respiratory rate, saturation of oxygen) on arrival, blood gas analysis findings on arrival, blood examination

Received: May 2, 2022
Accepted: October 20, 2022
Correspondence: Kenichi Muramatsu, Department of Acute Critical Care Medicine, Shizuoka Hospital, Juntendo University, 1129 Nagaoka, Izunokuni-shi, Shizuoka 410-2295, Japan
E-mail: muraken0928@gmail.com

findings on arrival, computed tomography findings upon arrival, culture results on arrival, and final outcome (return home, transfer to another hospital, admission to our hospital). In cases admitted to our hospital, we further evaluated the period of hospitalization, modified Rankin scale at discharge, causative diagnosis of difficulty moving and outcome at discharge (discharged home, discharged to another hospital, death).

The diseases discussed in the present study were defined as follows: rhabdomyolysis, creatine phosphokinase value over 200 IU/L; renal failure, creatinine value over 2.0 mg/dL; blood glucose abnormalities, glucose value under 70 mg/dL or over 200 mg/dL; anaemia, hemoglobin value under 10 g/dL; electrolyte disturbance, potassium value under 3 mEq/L or over 5 mEq/L, or sodium value under 130 mEq/L or over 150 mEq/L; hypoxia, SpO_2 under 90% or requiring oxygen administration; heat stroke, core body temperature over 39.0°C in a hot environment; hypothermia, core body temperature under 35.0°C; unstable circulation; systolic blood pressure, under 90 mmHg with clinical symptoms; infection, positive results of inflammatory response on blood examination with causative disease confirmed by a radiological study or urinalysis; and trauma, fresh fractures found on a radiological examination.

Furthermore, the subjects who were admitted to our hospital were divided into two groups based on their outcome: a favorable group (modified Rankin Scale at discharge of 0-2, indicating independence), and a poor group (modified Rankin Scale at discharge of 3-6, indicating dependence). Subjects who were transferred on the day of admission and whose final outcomes were unknown were excluded. The investigated variables were compared between the two groups.

Statistical analyses were performed using a non-paired Student's *t*-test, a median test, and a χ^2 test. Statistical significance was set at $P<0.05$. The variables with significance levels of $P<0.05$, based on the univariate analysis were included in the multivariate analysis. Data are presented as the mean ± standard deviation or median and quartiles.

Results

During the investigation period, our department provided initial care to 7,933 patients, among which 111 cases in which the patient's primary complaint was difficulty moving or adynamia were included in this study.

Table 1 presents the participants' background characteristics. The majority of patients were elderly, and all participants were independent of ADL before emergency transportation. Table 2 shows the results of the blood examinations performed in the 111 cases. Table 3 shows the results of the blood culture examinations performed in 77 cases. Table 4 shows the number of causative diagnoses of moving difficulty. The most frequent diagnosis was rhabdomyolysis, fol-

Table 1 Background of the subjects (n=111)

Sex (Male/Female)	59/52
Age (years)	76.3 ± 15.1
History	
Hypertension	47
Diabetes mellitus	23
Dementia	10
Activities of daily living (independent)	111 (100%)
Vital signs	
Glasgow Coma Scale	14 (14, 15)
Systolic blood pressure (mmHg)	131.7 ± 34.9
Heart rate (beats per minute)	87.7 ± 24.6
Respiratory rate (breaths per minute)	20.5 ± 5.4
Percutaneous saturated oxygen SPO_2 (%)	95.9 ± 3.7
Temperature (°C)	36.5 ± 2.3
Venous blood gas analysis	
pH	7.383 ± 0.100
PCO_2 (mmHg)	38.9 ± 8.8
HCO_3 (mmol/L)	23.2 ± 7.0
Lactate (mmol/L)	2.8 ± 2.0
Base excess (mmol/L)	−1.2 ± 7.1
Examination of computed tomography (yes/no)	46/65
Examination of blood culture (yes/no)	77/34

Table 2 Blood examination findings (n=111)

White blood cell count (/μL)	11,596 ± 6,727
Hemoglobin (g/dL)	12.3 ± 2.8
Platelet count (× 10^4/μL)	23.2 ± 18.9
Aspartate aminotransferase (IU/L)	92.5 ± 140.9
Alanine aminotransferase (IU/L)	48.8 ± 81
Lactate dehydrogenase (IU/L)	362.7 ± 19.4
Blood urea nitrogen (mg/dL)	37.4 ± 29.5
Creatinine (mg/dL)	1.48 ± 1.28
Creatine phosphokinase (IU/L)	1,750 ± 4,146
Sodium (mEq/L)	139 ± 6
Potassium (mEq/L)	4.1 ± 1.0
Chloride (mEq/L)	101 ± 7
Glucose (mg/dL)	150 ± 63
C-reactive protein (mg/dL)	6.4 ± 9.0
Fibrin degradation products (μg/dL)	18.6 ± 38
Brain natriuretic peptide (pg/mL)	241 ± 480

Table 3 Results of blood culture (n=77)

Organism	Number
Escherichia coli	2
Staphylococcus dysgalatiae	1
Staphylococcus aureus	1
Staphylococcus aureus (MRSA)	1
Staphylococcus epidermidis	1
Staphylococcus simulans	1
Klebsiella pneumoniae	1
Clostridium perfringens	1
Moraxella catarrhalis	1

Table 4 Total number of causative diseases

Rhabdomyolysis	60
Infection	47
Heat stroke or Hypothermia	35
Electrolyte disturbance	34
Blood glucose abnormality	28
Hypoxia	26
Renal failure	26
Anemia	19
Trauma	18
Unstable circulation	9
Dehydration	7
Malignancy	7
Autoinflammatory disease	5
Stroke	5
Cardio-vascular disease	5
Drug side effect	5
Psychiatric disease	3
Gastrointestinal disease	3
Endocrine disease	1

Table 5 Final outcomes

Global outcome	
Went home	11
Transferred	22
Admitted	78
Died	9
Discharged home	32
Discharged another hospital	37
Duration of hospitalization (days)	14.5 ± 20.7
Modified Rankin Scale at discharge	4 (2, 5)

lowed by infection, abnormal body temperature, electrolyte disturbance, blood glucose abnormality, hypoxia, and renal failure. The details of the less frequent diseases shown in Table 4 are as follows: broad-sense autoinflammatory diseases in four (pseudogout) and one (gout), mental disease in three (one each of anorexia nervosa, depression, and dissociative disorder), gastrointestinal disease in two (acute cholangitis) and one (upper gastrointestinal bleeding), and endocrine issues in one (hypothyroidism). Table 5 shows the final patient outcome, with "dependent on discharge" determined as the global outcome. Table 6 shows the results of the comparison between the two groups classified by the outcome. Overall, 34 and 55 patients were classified in the favorable and poor groups, respectively. Average age, proportion of females, infection and trauma, lactate glucose level, dehydrogenase, blood urea nitrogen, fibrin degradation products, and brain natriuretic peptide levels were significantly greater in the poor group than those in the favorable group. In contrast, the hemoglobin levels and proportions of dehydration, mental disease, and drug side effects in the poor group were significantly lower than those in the favorable group. Multivariate analysis revealed that trauma was the only significant predictor of a favorable outcome (LogWorth 1.9, P=0.01).

Discussion

This is the first report to describe the clinical characteristics of patients transported to the emergency room by ambulance with difficulty moving or adynamia as the main complaint. The main findings were as follows: patients were primarily elderly people, with the most frequent causative disease being rhabdomyolysis, followed by infection, abnormal body temperature, electrolyte disturbance, blood glucose abnormality, hypoxia, and renal failure.

In Japan, 60% of emergency patients are elderly[3]. Previous reports have indicated that diagnosing the causative disease in elderly patients with difficulty moving is challenging if an associated chief complaint is lacking[4–6].

The most common cause of difficulty moving observed in this study was rhabdomyolysis, which causes severe muscle pain, weakness, and/or stiffness, and can result in a decreased range of motion[7]. Three issues associated with rhabdomyolysis diagnosis were observed in the present study. The first was the fact that rhabdomyolysis was defined based solely on a creatine phosphokinase level over 200 IU/L. This is due to the fact that even a mild elevation in the creatine phosphokinase level may cause myalgia and muscle weakness, which may eventually lead to a patient developing difficulty moving. Second, there were many causes of rhabdomyolysis itself, such as infection, heat stroke, electrolyte disturbance, trauma, and drug side effects, which overlapped with the major causative diseases in the present study[8, 9]. The third issue is that difficult movement itself may induce bed sores and rhabdomyolysis[10]. Therefore, in some case, rhabdomyolysis was found to be the direct cause of the patient's difficulty moving, while in others it was found to be induced by other illnesses that are also associated with difficulty moving. Rhabdomyolysis demonstrated the highest frequency of all diseases observed in this study.

The second most frequent cause of moving difficulty in the present study was infection, which accounted for 47/111 (42%) of cases. Infection can cause increased levels of inflammatory cytokines and decreased activity experimentally[11, 12]. Clinically, reports have shown that pneumonia and urinary tract infection are frequently diagnosed as the cause of illness in elderly patients who present to the emergency department with a complaint of weakness or general malaise[13]. The prognosis of patients with sepsis whose chief complaint is unclear is poor[14, 15]. This suggests the importance of early recognition and initiation of treatment when the cause of immobility is infection. Accordingly, patients whose chief complaint is difficult to treat may require immediate septic management with culture sampling and antibiotics infusion.

Table 6 Comparison between the Favorable and Poor groups

	Poor group (n=55)	Favorable group (n=34)	*P*-value
General			
Age (year)	79.8 ± 10.8	67.5 ± 19.2	0.001
Sex (male/female)	25/30	24/10	0.02
Hypertension	24	15	0.9
Diabetes mellitus	11	7	0.9
Dementia	5	3	0.9
Vital signs			
Glasgow Coma Scale	14 (13,15)	15 (14,15)	0.08
Systolic blood pressure (mmHg)	133 ± 39.2	127 ± 32	0.3
Heart rate (beats per minute)	88 ± 24	85 ± 21	0.3
Respiratory rate (breaths per minute)	21 ± 5	19 ± 4	0.2
Saturation of oxygen (%)	95.5 ± 4.1	96.7 ± 2.8	0.09
Temperature (°C)	36.4 ± 2.6	36.8 ± 1.5	0.4
Venous blood gas analysis			
pH	7.378 ± 0.108	7.376 ± 0.097	0.3
PCO_2 (mmHg)	38.1 ± 8.7	38.4 ± 8.0	0.9
HCO_3^- (mmol/L)	22.7 ± 7.1	22.5 ± 7.5	0.4
Lactate (mmol/L)	2.9 ± 2.2	2.9 ± 1.8	0.4
Base excess (mmol/L)	−1.8 ± 7.5	−1.9 ± 7.4	0.5
Blood examination			
White blood cell count (/μL)	1,1878 ± 6,613	1,1794 ± 7,239	0.6
Hemoglobin (g/dL)	11.5 ± 2.9	13.2 ± 2.6	0.01
Platelet count ($\times 10^4$/μL)	24.7 ± 25.1	22.0 ± 10.7	0.8
Aspartate aminotransferase (IU/L)	95 ± 151	103 ± 162	0.9
Alanine aminotransferase (IU/L)	47 ± 60	64 ± 122	0.9
Lactate dehydrogenase (IU/L)	398 ± 231	309 ± 187	0.04
Blood urea nitrogen (mg/dL)	43 ± 33	26 ± 19	0.005
Creatinine (mg/dL)	1.48 ± 1.27	1.694 ± 1.56	0.4
Creatine phosphokinase (IU/L)	1,807 ± 4,942	1,859 ± 3,890	0.2
Sodium (mEq/L)	139 ± 7	138 ± 6	0.8
Potassium (mEq/L)	4.2 ± 1.0	4.0 ± 1.1	0.2
Chloride (mEq/L)	103 ± 7	100 ± 7	0.2
Glucose (mg/dL)	151.9 ± 56.6	151.8 ± 76.2	0.3
Uric acid (mg/dL)	7.6 ± 4.2	7.9 ± 2.7	0.2
C-reactive protein (mg/dL)	7.6 ± 9.8	5.6 ± 8.7	0.05
Fibrin degradation products (μg/dL)	25.3 ± 49.5	13.5 ± 24.6	0.001
Brain natriuretic peptide (pg/mL)	289 ± 520	105 ± 149	0.003
Duration of hospitalization (days)	21 ± 22	13 ± 20	0.007
Distribution of causative disease			
Rhabdomyolysis	32	14	0.1
Infection	31	8	0.002
Heat stroke or Hypothermia	13	13	0.1
Electrolyte disturbance	18	8	0.3
Blood glucose abnormality	15	7	0.4
Hypoxia	14	5	0.2
Renal failure	14	10	0.6
Anemia	13	4	0.1
Trauma	12	1	0.01
Unstable circulation	7	2	0.2
Dehydration	1	4	0.04
Malignancy	4	2	0.7
Autoinflammatory disease	2	2	0.6
Stroke	5	1	0.2
Cardio-vascular disease	1	3	0.1
Drug side effect	1	4	0.04
Psychiatric disease	0	3	0.02
Gastrointestinal disease	3	0	0.1
Endocrine disease	1	0	0.4

The third most frequent cause of difficulty in the present study was a disorder of body temperature, such as heat stroke or hypothermia. Thermoregulation in response to cold and heat stress is a vital function of the autonomic nervous system (ANS)[16]. Heat production and dissipation depend on a coordinated set of autonomic responses[16]. Autonomic nervous activity changes with increasing age, which is the main characteristic of the subjects in the present study[16]. Elderly people tend to develop both hyperthermia and hypothermia more easily because of the innate physiological changes associated with aging, in addition to the presence of chronic disease and polypharmacy[17]. A previous report found that both hypothermia and hyperthermia can induce muscle dysfunction, which can lead to difficulty moving[16].

The fourth-most frequent cause of difficulty moving in the present study was electrolyte disturbance (hyperkalemia, 15 cases; hypokalemia, 12 cases; hypernatremia, 6 cases; hyponatremia, 6 cases). Hypokalemia is well known to induce muscle weakness, which can lead to moving difficulty[18]; however, hyperkalemia can also induce muscle weakness[19, 20]. Secondary hyperkalemic paralysis is likely caused by abnormal depolarization of the nerve membrane due to excessive increases in serum potassium concentrations[21]. However, sarcopenia, as a cause of low potassium body content, can induce or co-induce hyponatremia, particularly in elderly individuals with the frailty phenotype[21]. Hypernatremia can also show non-specific symptoms such as anorexia, muscle weakness, restlessness, nausea, and vomiting in the early phase[22]. These reports support the induction of movement difficulties due to electrolyte disturbance.

The fifth-most frequent cause of difficulty in the present study was abnormal blood glucose levels. Previous reports have shown that both hyperglycemia and hypoglycemia can directly or indirectly induce muscle weakness[23–26]. Unstable circulation, including dehydration, anemia, and/or hypoxia, leads to cellular and tissue hypoxia, resulting in cellular death and dysfunction of vital organs[27]. Circulating red blood cells contribute to microcirculatory hypoxic vasodilation via nitric oxide (NO)-dependent vasodilation, thereby facilitating the delivery of oxygen to oxygen-deprived tissue[28]. Anemia, dehydration, cardiovascular disease, renal failure, hemorrhage from gastrointestinal disease, and hypothyroidism can induce unstable circulation or hypoxic status. Accordingly, these diseases contribute to the dysfunction of vital organs, which can lead to difficulty in movement. However, pain from trauma, malignancy, or autoimmune disease can also directly lead to movement difficulty, in addition to hypercytokinemia, which can induce negative effects of systemic inflammation on muscle strength[29–31]. Stroke, drug side effects, and psychiatric diseases can all contribute to the occurrence of ataxia, which can lead to difficulty in movement.

The finding that trauma (fracture) was the only significant predictor of a favorable outcome may have been because patients could receive social rehabilitation after fixation of the fracture and rehabilitation.

The present study showed that a variety of diseases can cause difficulties in movement. As no clear diagnostic algorithm has yet been established for emergency patients transported for a chief complaint of difficulty moving[32], the present findings suggest the importance of obtaining the patient's history, evaluating vital signs, conducting a physical examination, laboratory examinations including blood culture, and physiological and radiological studies, including computed tomography.

The main limitation of the present study was its retrospective nature and small sample size enrolled from a single medical institute. Prospective surveys and studies should be conducted through joint research at other facilities in the future to verify these findings.

Conclusion

Patients who were brought to the emergency room with a chief complaint of difficulty moving or adynamia were retrospectively analyzed. These patients were predominantly elderly and had a variety of causative diseases. This indicates that multiple approaches are required to manage these patients. Except for diseases that are difficult to treat, such as malignancy, stroke, and trauma, many primary illnesses, such as infection and heat stroke, present with rhabdomyolysis and require attention in diagnosis and treatment.

Acknowledgements

This work was supported in part by a Grant-in-Aid for Special Research in Subsidies for ordinary expenses of private schools from the Promotion and Mutual Aid Corporation for Private Schools of Japan.

References

1. Villa-Forte A. Difficulty moving. MSD MANUAL Consumer Version modified Feb 2021. https://www.msdmanuals.com/home/bone,-joint,-and-muscle-disorders/symptoms-of-musculoskeletal-disorders/difficulty-moving.
2. von Schroeder HP, Coutts RD, Lyden PD, *et al*. Gait parameters following stroke: a practical assessment. J Rehabil Res Dev 1995; 32: 25–31. [Medline]
3. Number of emergency calls for service in the year 2020. Ministry of Internal Affairs and Communications. Chrome-extension://efaidnbmnnnib-

pcajpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fwww.fdma.go.jp%2Fpressrelease%2Fhoudou%2Fitems%2F211224_kyuuki_1.pdf&clen=1055668&chunk=true (March 10, 2022).
4. Lessa AH, Costa MJ. The impact of speech rate on sentence recognition by elderly individuals. Rev Bras Otorrinolaringol (Engl Ed) 2013; 79: 745–752. [Medline]
5. Renard D, Rubli E, Voide N, *et al*. Spectrum of digoxin-induced ocular toxicity: a case report and literature review. BMC Res Notes 2015; 8: 368. [Medline] [CrossRef]
6. Yuan Y, Huang F, Gao ZH, *et al*. Delayed diagnosis of prosopagnosia following a hemorrhagic stroke in an elderly man: a case report. World J Clin Cases 2020; 8: 6487–6498. [Medline] [CrossRef]
7. Paulsen G, Benestad HB. Muscle soreness and rhabdomyolysis. Tidsskr Nor Laegeforen 2019; 139: 139 (in Norwegian). [Medline]
8. Cabral BMI, Edding SN, Portocarrero JP, *et al*. Rhabdomyolysis. Dis Mon 2020; 66: 101015. [Medline] [CrossRef]
9. Long B, Koyfman A, Gottlieb M. An evidence-based narrative review of the emergency department evaluation and management of rhabdomyolysis. Am J Emerg Med 2019; 37: 518–523. [Medline] [CrossRef]
10. Levine JM. Rhabdomyolysis in association with acute pressure sore. J Am Geriatr Soc 1993; 41: 870–872. [Medline] [CrossRef]
11. Lee CH, Giuliani F. The role of inflammation in depression and fatigue. Front Immunol 2019; 10: 1696. [Medline] [CrossRef]
12. Yamato M, Tamura Y, Eguchi A, *et al*. Brain interleukin-1β and the intrinsic receptor antagonist control peripheral Toll-like receptor 3-mediated suppression of spontaneous activity in rats. PLoS One 2014; 9: e90950. [Medline] [CrossRef]
13. Bhalla MC, Wilber ST, Stiffler KA, *et al*. Weakness and fatigue in older ED patients in the United States. Am J Emerg Med 2014; 32: 1395–1398. [Medline] [CrossRef]
14. Filbin MR, Lynch J, Gillingham TD, *et al*. Presenting symptoms independently predict mortality in septic shock: importance of a previously unmeasured confounder. Crit Care Med 2018; 46: 1592–1599. [Medline]
15. Sauter TC, Capaldo G, Hoffmann M, *et al*. Non-specific complaints at emergency department presentation result in unclear diagnoses and lengthened hospitalization: a prospective observational study. Scand J Trauma Resusc Emerg Med 2018; 26: 60. [Medline] [CrossRef]
16. Cheshire WP Jr. Thermoregulatory disorders and illness related to heat and cold stress. Auton Neurosci 2016; 196: 91–104. [Medline] [CrossRef]
17. Brody GM. Hyperthermia and hypothermia in the elderly. Clin Geriatr Med 1994; 10: 213–229. [Medline] [CrossRef]
18. Glancy DL, Subramaniam PN, Rodriguez JF. Lower extremity paralysis. Am J Cardiol 2016; 118: 1609–1610. [Medline] [CrossRef]
19. Wilson NS, Hudson JQ, Cox Z, *et al*. Hyperkalemia-induced paralysis. Pharmacotherapy 2009; 29: 1270–1272. [Medline] [CrossRef]
20. Evers S, Engelien A, Karsch V, *et al*. Secondary hyperkalaemic paralysis. J Neurol Neurosurg Psychiatry 1998; 64: 249–252. [Medline] [CrossRef]
21. Bertini V, Nicoletti C, Beker BM, *et al*. Sarcopenia as a potential cause of chronic hyponatremia in the elderly. Med Hypotheses 2019; 127: 46–48. [Medline] [CrossRef]
22. Kim SW. Hypernatemia: successful treatment. Electrolyte Blood Press 2006; 4: 66–71. [Medline] [CrossRef]
23. Rozance PJ, Hay WW Jr. Describing hypoglycemia—definition or operational threshold? Early Hum Dev 2010; 86: 275–280. [Medline] [CrossRef]
24. Nannapaneni N, Elkhider A, Steinberg J. Hypoglycemic hemiparesis: the stroke masquerader. Am J Med 2014; 127: e13. [Medline] [CrossRef]
25. Vanhorebeek I, Latronico N, Van den Berghe G. ICU-acquired weakness. Intensive Care Med 2020; 46: 637–653. [Medline] [CrossRef]
26. Omura T, Araki A. Skeletal muscle as a treatment target for older adults with diabetes mellitus: the importance of a multimodal intervention based on functional category. Geriatr Gerontol Int 2022; 22: 110–120. [Medline] [CrossRef]
27. Koya HH, Paul M. Shock. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing;2022 Jan. 2021 Jul 26.
28. Weinberg JA, Patel RP. Red blood cell transfusion and its effect on microvascular dysfunction in shock states. Best Pract Res Clin Anaesthesiol 2016; 30: 491–498. [Medline] [CrossRef]
29. Relja B, Horstmann JP. Traumatic Injury. Experientia Suppl 2018; 108: 85–110. [Medline] [CrossRef]
30. Lippitz BE. Cytokine patterns in patients with cancer: a systematic review. Lancet Oncol 2013; 14: e218–e228. [Medline] [CrossRef]
31. Degens H. The role of systemic inflammation in age-related muscle weakness and wasting. Scand J Med Sci Sports 2010; 20: 28–38. [Medline] [CrossRef]
32. Birrenbach T, Geissbühler A, Exadaktylos AK, *et al*. A dangerously underrated entity? Non-specific complaints at emergency department presentation are associated with utilisation of less diagnostic resources. BMC Emerg Med 2021; 21: 133. [Medline] [CrossRef]