

Clinical Research of Pre-Hospital Emergency Care, Nursing, Infection Prevention and Control for Senile Osteoporotic Vertebral Compression Fracture during Epidemic Period

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Abstract

Background: Novel coronavirus pneumonia (NCP) and osteoporotic vertebral compression fractures (OVCF) are the high incidences of diseases in the elderly. During the epidemic period, if not treated in time, the complications are high and the mortality is high. If we do not pay attention to infection prevention and control in pre-hospital emergency care, it will lead to the first time infection of medical staff and in-hospital cross infection in emergency outpatient receiving area. The correct consideration of both and the establishment of perfect pre-hospital emergency treatment and infection prevention and control synchronous strategy is an important premise to ensure the stable, orderly and safe medical treatment. **Objective:** To explore the effect of synchronous implementation of pre-hospital emergency care, nursing and infection prevention and control for senile OVCF during the epidemic. In order to improve the efficiency of pre-hospital emergency care and prevent the spread of infection. **Method:** A total of 92 elderly patients with OVCF who received pre-hospital treatment in 18 hospitals in Zhangjiakou City during the epidemic prevention and control period from January 2020 to November 2022 and met the inclusion criteria were selected as research objects, including 24 males and 68 females, aged 65 - 82 (74.2 ± 2.2) years. All patients were associated with concomitant injuries and underlying diseases. All patients in this group underwent predictive pre-hospital rescue and infection prevention and control procedures. **Results:** All the 92 elderly patients with OVCF received timely pre-hospital treatment during the epidemic period,

and no aggravation occurred of the 92 patients, 35 were in the high risk area, 10 were in the medium risk area, and 47 were in the low risk area. Exclude OVCF for NCP Patients were treated according to the conventional diagnosis and treatment principles. Suspected and confirmed cases are transferred to designated surgical hospitals for treatment. All patients were followed up 3 months, 6 months and 12 months after treatment. There was no death rate, high satisfaction of pre-hospital first aid, high diagnostic accuracy, and good curative effect. None of the rescue personnel had any infection rate, and no hospital infection transmission and nosocomial cross infection occurred. **Conclusion:** It is the first step to safely treat patients and prevent cross infection to establish a perfect synchronous strategy of pre-hospital first aid and infection prevention and control.

Keywords

Novel Coronavirus Pneumonia, Osteoporotic Vertebral Compression Fracture, Pre-Hospital First Aid, On-Site Treatment, Epidemic Risk Assessment, Screening Process, Infection Prevention and Control, Synchronization

1. Introduction

Osteoporotic vertebral compression fracture (OVCF) is a common complication of osteoporosis and a common disease in the elderly [1]. Vertebral compression fracture can lead to persistent local pain, which seriously affects patients' quality of life and mobility, and is one of the important reasons for the increase of mortality in the elderly, which is 23% - 34% higher than that in patients without OVCF [2] [3]. At present, NCP is repeating at home and abroad. The World Health Organization (WHO) has named NCP as 2019 Corona Virus Disease (COVID-19). With rapid spread and strong virulence, the population is generally susceptible to the disease, but the elderly are more susceptible to infection due to low immunity, with more complications and high mortality [4] [5]. Both OVCF and NCP are common diseases of the elderly, and are often accompanied by low immunity and a variety of basic internal diseases. Timely treatment is required after fracture, otherwise it will lead to higher complications and mortality [6] [7]. Pre-hospital treatment is the vanguard of the entire diagnosis and treatment system, and simultaneous rapid and safe treatment with epidemic prevention and control is the guarantee of successful follow-up treatment. At present, there are no such reports at home and abroad [6] [7]. From January 2020 to November 2022, the author applied predictive pre-hospital emergency treatment to elderly patients with OVCF in urban areas of Zhangjiakou and all counties and districts, aiming to improve the emergency treatment level of OVCF and prevent infection transmission. All patients received comprehensive and accurate treatment, with no cross infection in the hospital and zero infection rate

among medical staff. The results are reported as follows.

2. Data and Methods

2.1. Inclusion Criteria

1) Confirmed cases of OVCF; 2) Patients who meet the indications of minimally invasive percutaneous vertebroplasty; 3) Elderly patients receiving pre-hospital treatment from emergency centers during epidemic prevention and control; 4) Clear consciousness after injury; 5) Clinical data were complete and followed up.

2.2. Exclusion Criteria

1) no pre-hospital first aid; 2) Those who refuse hospitalization; 3) There are space-occupying lesions in the spinal canal and vertebra or spinal infection; 4) Post-injury consciousness disorder; 5) Incomplete or missing follow-up data.

2.3. General Information

A total of 92 elderly patients with OVCF who received pre-hospital treatment in 18 hospitals (15 level-II hospitals and 3 level-III hospitals) in Zhangjiakou City during the epidemic prevention and control period from January 2020 to November 2022 and met the inclusion criteria were selected as research objects, including 24 males and 68 females, aged 65 - 82 (74.2 ± 2.2) years. 62 cases were single vertebral fractures and 30 cases were multiple vertebral fractures. Combined injuries: 5 cases were combined with craniocerebral trauma, 6 cases were combined with femoral neck fracture, 8 cases were combined with femoral intertrochanteric fracture, and 9 cases were combined with surgical neck fracture of humerus. Basic diseases: 56 patients with hypertension, heart disease, 38 patients with diabetes, 19 patients with chronic obstructive pulmonary disease, 18 patients with cerebrovascular disease. Time of injury: 0.5 - 72 (2.1 ± 0.2) hours. The pre-hospital first aid time is 11 - 45 minutes, and the first aid journey is 0.5 - 15 km.

This clinical study was authorized and approved by the Ethics Committee of Zhangjiakou Orthopedics Quality Control Center (batch number: 2020-01).

2.4. Methods

All 92 elderly patients with thoracolumbar OVCF underwent pre-hospital emergency care, nursing and infection prevention and control procedures.

2.4.1. All Staff of Trauma Emergency Centers Receive Training on Epidemic Prevention and Control Knowledge

All medical staff and ambulance drivers in trauma emergency centers need to keep learning the latest knowledge of NCP prevention and control, understand the division of high, medium and low risk areas in the region, and master the classification criteria for patients, the diagnostic criteria for NCP and the three-

level protection criteria for medical staff. Be familiar with the screening process of emergency and outpatient treatment of OVCF patients during the epidemic prevention and control period and the trauma treatment channel of one-stop rapid examination in the hospital.

2.4.2. Before Leaving the Hospital, Make Preparations for the Normalization of People, Vehicles and Objects and the Prevention and Control of the Epidemic, Make Injury Inquiries and Epidemic Risk Assessments on the Way There

The medical staff participating in the first aid is provided with normal level 3 protection, and the negative pressure ambulance is always maintained in a sterilized state. The ambulance is routinely equipped with first aid drugs and articles for diseases such as heart, lung, brain, spine injury and limb fracture. Including cardiac defibrillator, tracheal intubation kit, rigid spine stretcher, cervical collar, limbs pelvic fracture fixation supports, infusion and nucleic acid or antigen collection related items. After receiving the emergency call, ask the injured person's location and navigation in detail. The ambulance will depart within 1 min during the day and 3 min at night. During the driving of the vehicle, the medical staff carried out epidemic risk assessment on the patients and the places, kept the telephone unimpeded, determined the basic diseases according to the statements of the on-site personnel or the patient's family members, predicted the patient's current injury condition, and prepared the corresponding drugs and articles in advance. For those suspected of thoracolumbar fracture, instruct on-site personnel through telephone, do not move the patient at will, so as to avoid inducing or aggravating spinal cord injury.

2.4.3. On-Site First Aid, Injury Control and Assessment

Upon arrival at the scene, medical staff should quickly observe the appearance and make a preliminary judgment, quickly monitor vital signs such as blood pressure, pulse, respiration, body temperature, blood oxygen saturation and pain, quickly determine the patient's state of consciousness, inquire the patient's cause of injury, time and past medical history, and classify the patient's epidemic situation. At the same time, rapid physical examination of the head, chest, spine, pelvis and limbs was completed to determine the key injuries. For patients with dyspnea, air bag or on-site endotracheal intubation should be taken immediately; Suspected craniocerebral injury, immediately give the head to one side of the supine position, and maintain airway patency, while paying attention to avoid the head vibration. Patients with hemorrhage should be treated with pressure bandage and hemostasis immediately. The patients with fracture of limbs or pelvis were treated with external fixation brace brake, and the patients with rib fracture were treated with chest wall fixation. Spinal injury suspected, supine braking, careful examination of neurological symptoms, assessment of the extent of injury and concomitant injury. Patients with chronic cardiovascular and lung diseases should be given oxygen immediately, and emergency drugs should be applied according to the doctor's advice.

2.4.4. Transport

After the patient's condition is basically stabilized, the patient is temporarily fixed with a spinal brace. The patient is moved to a rigid spine stretcher by using the flat support method or rolling method, and the patient and stretcher are fixed with broadband. At least three people are needed to move the injured person. Keep the axis of the spine stable. Do not sway or twist the injured spine back and forth, which may aggravate the spinal or combined injury and increase the risk of disability. The transport was smooth and rapid, reducing turbulence, and closely observing the changes of patients' vital signs, especially the patency of breathing, pulse and venous channels. One person should immediately collect nasopharyngeal swab samples for 2019-nCoV nucleic acid and antigen detection. At the same time, contact the hospital emergency center or designated isolation hospital to prepare the green channel for admission screening and emergency examination. The other person is responsible for making detailed and accurate records of the patient's age, gender, address, time of onset, cause, vital signs, patient classification, injury assessment, on-site and in-transit first aid and nursing measures and effects, so as to facilitate the rapid handover of follow-up treatment and evaluation with the receiving medical staff after arriving at the hospital.

2.4.5. End of the Transfer

After the transfer, the ambulance is driven to the designated disinfection point for final disinfection, Windows are opened for ventilation, and the surfaces of the vehicle and its contents are wiped with hydrogen peroxide spray or chlorine-containing disinfectant. Pre-hospital rescue workers should carry out standardized disinfection and change isolation clothing and protective equipment according to the risk area of the epidemic, patient classification and nucleic acid test results.

3. Results

The 92 elderly patients with OVCF in this group received timely pre-hospital treatment during the epidemic period, among which the patients complicated with craniocerebral trauma, limb fractures and basic diseases did not suffer from aggravation of the injury according to the instructions of the rescue personnel. Of the 92 patients, 35 were in the high risk area, 10 were in the medium risk area, and 47 were in the low risk area. Among them, 16 patients in the high risk area were preliminarily identified as suspected cases, and 13 cases were confirmed and 3 cases were excluded through outpatient and emergency screening in designated hospitals. Among the other 30 patients in high/medium risk area-risk areas, 2 cases were confirmed by screening in non-designated hospitals. Patients with OVCF who were excluded from NCP were treated according to conventional treatment principles, and minimally invasive PKP surgery was performed after admission and personalized treatment was given for the combined injury. Suspected and confirmed cases are transferred to designated surgical hos-

pitals for treatment. All patients were followed up at 3 months, 6 months and 12 months after treatment. There was no mortality, high satisfaction and diagnostic accuracy in pre-hospital emergency care, good prognosis of OVCF, zero infection rate among the rescue personnel, and no hospital-based infection transmission and nosocomial cross infection.

4. Discussion

4.1. The Importance of Strengthening Pre-Hospital Emergency Medical Staff's Knowledge of Epidemic Prevention and Control

In addition to mastering professional treatment techniques, pre-hospital ambulance staff must be proficient in the classification of high, medium and low risk areas, patient classification, three-level protection for medical staff, clinical manifestations and diagnostic criteria of NCP during epidemic prevention and control, which is the premise of safe treatment of patients and prevention of cross infection.

4.1.1. Delineation of Epidemic Risk Areas

Zones of high, medium and low risk should be designated according to the risk of epidemic transmission and whether there are infected people. High risk areas: places where cases and asymptomatic infected persons live, and places of work and activities with frequent activities and high risk of transmission of the epidemic are designated by residential communities (villages) in principle; medium risk area: the work and activity areas where cases and asymptomatic infected persons stay and move for a certain period of time and may have the risk of epidemic transmission. The scope can be defined according to the results of the epidemiological survey. Low-risk areas: the areas under the jurisdiction of the county (city or district) where the epidemic occurred, other areas except high and medium risk areas. There were 92 patients in this group, including 35 cases in high risk area, 10 cases in medium risk area and 47 cases in low risk area.

4.1.2. Patient Classification and Case Diagnosis Criteria during the Epidemic

All patients under pre-hospital treatment were divided into four categories according to the following conditions: **Category I**, The patient has not been to the affected area within the last 14 days, has no history of direct or indirect contact with people in the affected area, and has no suspected or confirmed NCP cases in the area where the patient lives; The patient had no clinical symptoms, and all laboratory tests, imaging tests and nasopharyngeal swabs tested negative for NCP nucleic acid. **Category II**, the patient has a history of direct or indirect contact with people in the epidemic area within the past 14 days, and the patient lives in the area with suspected or confirmed NCP cases; The patient showed no clinical symptoms of NCP and all auxiliary tests were negative. In the past two weeks, none of the close contacts of the patient showed any clinical symptoms related to

the novel coronavirus pneumonia. **Category III**, with an epidemiological history and coincident clinical manifestations (fever and/or respiratory symptoms; Imaging findings of pneumonia; Normal or decreased total white blood cell count, reduced lymphocyte count) of any 2; Or have no clear epidemiological history, but meet 3 of the clinical manifestations, diagnosed as suspected patients with novel coronavirus pneumonia; **Category IV**, Suspected cases with positive nucleic acid tests or those who have not received NCP vaccine but have positive IgM and IgG antibodies specific to NCP are diagnosed as confirmed NCP pneumonia patients.

4.1.3. Tertiary Protection for Medical Personnel during the Epidemic

Level 1 protection: strictly abide by the standard precautionary principle, abide by the rules and regulations of disinfection and isolation, medical staff wear work caps, surgical masks, overalls and isolation clothes, and wear latex gloves if necessary. **Level 2 protection:** In addition to level 1 protection, medical staff should wear a medical protective mask (N-95 mask), double gloves and shoe covers. **Level 3 protection:** On the basis of level 2 protection, medical workers wear protective clothing, masks or comprehensive respiratory protection devices, waterproof boot covers, shoe covers, and waterproof aprons if necessary. All the medical staff involved in pre-hospital emergency treatment adopted tertiary protection.

4.2. Establish Screening Procedures for Emergency and Outpatient Treatment of OVCF Patients during Epidemic Prevention and Control

During the period of epidemic prevention and control, elderly patients with OVCF arriving at the emergency room of general hospital or designated isolation hospital should be treated under the premise of saving lives first and ensuring the “safe rescue principle” of medical staff. Medical staff in emergency, infection and trauma multidisciplinary teams who were notified to wait in advance should take precautions according to NCP level III precautions. They should ask for medical history and check vital signs and oxygen saturation as soon as possible. Patients with medium-high risk areas or class II or above, or patients and their family members cannot accurately describe the epidemiological history, should be treated as suspected cases. Pre-hospital nasopharyngeal swabs were rapidly screened for 2019-nCoV infection at the clinical reception, and all patients underwent relevant tests and examinations according to the emergency and outpatient screening flow chart. Patients with OVCF with suspected or confirmed NCP should seek treatment in the fever Clinic, which should request a spinal surgery specialist consultation. All NCP patients (including suspected and confirmed patients) are strictly isolated in designated medical institutions where conditions are available, and individualized treatment strategies are developed according to the conditions of NCP OVCF patients [6] [7] [8]. During outpatient and emergency clinical reception, the standardized NCP screening proce-

dures were implemented for all 92 patients in our group. In designated hospitals, 13 confirmed cases were screened out of 16 suspected cases and 3 suspected cases were ruled out. In the non-designated hospital, two confirmed cases were screened out of 30 patients from the medium-high risk area.

4.3. Improve the Standardized Disinfection of Personnel, Vehicles and Articles after Pre-Hospital Emergency Treatment

After the task is completed, medical workers participating in pre-hospital emergency should change their gloves, take off protective clothing and foot covers, and discard them in the designated medical trash can. After taking off hand covers, disinfect hands with hand disinfectant according to the seven-step washing method, take off the protective clothing, face mask, protective goggles/face screen, and disinfect the goggles and face mask with disinfecting tissue, and wipe them with clean water gauze. All participants leave the work area after bathing and changing. After use, the negative pressure ambulance will be driven to the designated cleaning station for final disinfection, and the interior environment of the transport vehicle and the surface of articles will be jointly disinfected. The surface will be first followed by the space, and the process will be repeated 2 - 3 times. When disinfecting the air and surface, it is required to form a dense fog in a closed space and pay attention to the amount of drugs. Spray to the degree of uniform wetting. If there are visible contaminants, remove them completely before disinfect them. Use 1000 mg/L effective chlorine disinfectant or 500 mg/L chlorine dioxide disinfectant to wipe or spray to disinfect the environment and surface inside the ambulance. Keep it closed for at least 30 minutes. Then turn on ventilation and/or mechanical ventilation. Finally wipe with water to remove chlorine clean. Wheelhouse and medical cabin disinfection and cleaning equipment should be strictly separated. There was no infection rate between the medical staff and ambulance drivers, and no ambulance-transmitted infection and nosocomial cross infection occurred.

5. Summary

During the period of epidemic prevention and control, there may be virus carriers or asymptomatic infected patients in OVCF patients. How to put life first, not only to save patients and protect medical staff from infection, but also to strictly prevent the occurrence of hospital cluster transmission events, and to establish perfect pre-hospital emergency measures and infection prevention and control strategies is the key. The transfer of suspected and confirmed patients to designated isolation hospitals during pre-hospital emergency care reduces the risk of non-designated hospital infections. Pre-hospital ambulance personnel must be proficient in the division of high, medium and low risk areas, patient classification, clinical manifestations and diagnostic criteria of NCP, and do well in outpatient and emergency screening procedures, personnel protection, and standardized disinfection of vehicles and equipment, which is of great signi-

ficance to ensure the smooth, orderly and safe medical treatment.

The shortcomings of this study lie in the lack of comparison of the control group. The number of cases is relatively small and the follow-up time is short. Therefore, medium and long-term follow-up and evaluation should be made. How to better apply multi-disciplinary and multi-mode pre-hospital emergency care needs further research.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Xue, G., Yang, X.M. and Zhang, Y. (2022) Percutaneous Vertebroplasty in Treatment of Osteoporotic Vertebral Compression Fracture by Two Different Approaches: Bone Cement Leakage and Safety. *Chinese Journal of Tissue Engineering Research*, **26**, 4730-4734.
- [2] Gao, X.D., Qiao, F., Che, W.S., *et al.* (2022) Expert Consensus on Prevention and Control of Infection in COVID-19 Designated Hospitals. *Chinese Journal of Nosocomiology*, **32**, 1-8.
- [3] Mc Carthy, J. and Davis, A. (2016) Diagnosis and Management of Vertebral Compression Fractures. *American Family Physician*, **94**, 44-50.
- [4] National Health Commission of the PeoWorld Health Organization (2022) WHO Coronavirus (COVID-19) Dashboard.
- [5] National Health Commission of the People's Republic of China (2022) Diagnosis and Treatment Plan for COVID-19 (Trial Version 9). *Chinese Journal of Clinical Infectious Diseases*, **15**, 81-89.
- [6] Yang, X.M., Zhang, Y., Jia, Y.L., *et al.* (2022) Clinical Diagnosis, Classification and Individualized Treatment Strategy of Osteoporotic Vertebral Compression Fractures during the Epidemic Prevention and Control of COVID-19. *Annals of Case Reports*, **7**, 1-5. <https://doi.org/10.29011/2574-7754.101012>
- [7] Yang, X., Zhang, Y., Jia, Y., *et al.* (2022) To Establish a Standardized Diagnosis and Treatment Process and Perioperative Protection Strategy for Osteoporotic Vertebral Compression Fracture during the Prevention and Control of COVID-19. *Mega Journal of Case Reports*, **5**, 2001-2010.
- [8] Yang, X.M., Chen, L.X., Yao, Y., *et al.* (2022) Diagnosis and Treatment and Infection Protection Strategy of OVCF Minimally Invasive PKP Surgery during the Prevention and Control of COVID-19. *Surgical Science*, **13**, 161-173. <https://doi.org/10.4236/ss.2022.1312062>