



Case report

Management strategies for neglected simultaneous bilateral femoral neck fractures: Case report and literature review

Arvin Najafi^a, Salman Azarsina^a, Dorsa Hadavi^b, Rahele Arkian^c, Sevak Hatamian^d,
Pouria Chaghmirzayi^{e,*}

^a Orthopedic Surgery, Shahid Madani Hospital, Alborz University of Medical Sciences, Karaj, Iran

^b Tehran University of Medical Sciences, Tehran, Iran

^c Alborz University of Medical Science, Karaj, Iran

^d Anesthesiology and Special Care, Clinical Research Development Unit of Shahid Madani Hospital, Alborz University of Medical Science, Karaj, Iran

^e Clinical Research Development Unit of Shahid Madani Hospital, Alborz University of Medical Science, Karaj, Iran

ARTICLE INFO

Keywords:

Simultaneous fractures
Bilateral fractures
Femoral neck fractures
Neglected fractures
Narcotic addiction
Hemiarthroplasty
Surgical management

ABSTRACT

Introduction and importance: Simultaneous bilateral femoral neck fractures are rare and challenging, often occurring due to high-energy trauma in younger adults or low-energy trauma compounded by metabolic issues in elderly populations. Neglected cases, particularly in the context of narcotic addiction and limited access to healthcare, present unique management dilemmas. This study aims to contribute insights into the clinical presentation, management strategies, and outcomes of two neglected simultaneous bilateral femoral neck fractures. **Case presentation:** We present two cases: a 65-year-old woman and a 45-year-old man, both with a history of narcotic addiction, who presented with neglected simultaneous bilateral femoral neck fractures. Both cases demonstrated significant pain and functional impairment necessitating surgical intervention. **Clinical discussion:** Treatment involved one-stage bilateral hip hemiarthroplasty, which successfully restored function without postoperative complications during follow-up periods of 14 and 16 months. Discussion includes the challenges of diagnosing and managing neglected fractures in vulnerable populations, emphasizing the importance of early recognition and tailored surgical approaches. **Conclusion:** Our study suggests the efficacy of one-stage bilateral hip hemiarthroplasty in managing neglected simultaneous bilateral femoral neck fractures due to narcotic addiction. However, variability in outcomes across different surgical techniques highlights the need for individualized treatment plans based on patient-specific factors.

1. Introduction

Elderly people frequently suffer femoral neck fractures, which are commonly brought on by low-energy trauma. It usually results from high-energy trauma and is less common in younger adults [1]. Despite poor prognosis and variable outcomes, some of these fractures remain undiagnosed or untreated, especially in developing countries, due to a lack of treatment facilities, poor-quality implants, and socioeconomic factors [1–3]. When medical attention is not sought after the initial injury, within 20 to 30 days, a femoral neck fracture is deemed neglected [4,5]. While simultaneous bilateral femoral neck fractures are rare [6], neglected cases of simultaneous bilateral femoral neck fractures are scarce, and only a few cases have been reported [3,7–9]. Various

methods for treating bilateral femoral neck fractures have been detailed in the literature. These approaches include hemiarthroplasty or total hip arthroplasty, which can be performed in one or two stages; open reduction and internal fixation; open fixation combined with valgus intertrochanteric osteotomy; and in situ fixation [3,10–12]. Due to their rarity, there is limited experience documented in the literature for managing neglected simultaneous bilateral femoral neck fractures [3,7–9].

Here, we present two patients with narcotic addiction who were diagnosed with neglected simultaneous bilateral femoral neck fractures. We discuss the causes and management options based on cases reported in the literature. This study has been reported in line with the SCARE criteria [13].

* Corresponding author at: Building Number 25, west Bahar Street, Golshahr Street, Karaj 3198636741, Iran.

E-mail address: pouriachaghmirzayi@yahoo.com (P. Chaghmirzayi).

<https://doi.org/10.1016/j.ijscr.2024.110332>

Received 1 August 2024; Received in revised form 16 September 2024; Accepted 20 September 2024

Available online 24 September 2024

2210-2612/© 2024 The Authors. Published by Elsevier Ltd on behalf of IJS Publishing Group Limited. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2. Case presentations

2.1. Case 1

After experiencing 40 days of groin pain and an inability to bear weight on both legs following a car accident, a 65-year-old woman with a 20-year history of intravenous narcotic drug (Heroin) abuse was referred to the emergency department. She was assessed in the hospital on the same day of the accident with the chief complaints of mild pelvic pain; plain pelvic radiography was done with normal results (Fig. 1), and she was discharged from the hospital. In the second pelvic radiography that was done 40 days after the accident, both femurs are fractured clearly in the neck region (Pauwels classification: Type III on both sides) with noticeable displacement on both sides (Fig. 1). Although she attempted to alleviate the pain with increasing opioid consumption, she was finally admitted to orthopedic surgery service with a diagnosis of neglected simultaneous bilateral femoral neck fractures. She took no medications and had no known comorbidities. The patient had no job or health insurance and was cared for and financially supported by her son. Both legs were edematous; no limb shortening, deformities, or discoloration was found. All vascular, neuromuscular, sensory, and motor nerve examinations were normal, but there was a painful passive and active range of motion. All tested parameters were within normal limits, including blood count, metabolic and endocrine markers, and 24-h urinary excretion of calcium and phosphorus. No bone health related metabolic or endocrine disorders were identified. According to the patient's activity following analgesia (although limited) and no DVT-related signs or symptoms, the blood level of D-dimer was checked preoperatively, which was negative.

Bipolar hemiarthroplasty was considered for the patient due to the socio-economic conditions of the patient, addiction, low treatment compliance, and the risk of falling. After receiving spinal anesthesia, the patient was placed in a lateral position on a standard operating table. We used a direct lateral approach for the incisions on both sides. The second side was prepared and draped after completing the first side surgery. A

one-staged cementless bipolar hemiarthroplasty surgery technique replaced femur heads on both sides (Fig. 2). A senior surgeon performed the surgery. Fracture sites Biopsy histopathological results revealed no metabolic disorders or malignancy. The surgery was performed without complications, and the patient completely recovered during the 14-month follow-up period (Hip Harris score: 83.00).

2.2. Case 2

A 45-year-old man was referred to the emergency department after experiencing 35 days of bilateral hip pain that began following the lifting of a heavy load. His medical history includes 15 years of intravenous narcotic drug (Heroin) abuse. He took no medications and had no known comorbidities. The patient had no job or health insurance and was cared for and financially supported by his wife. The patient stated that he felt severe pain while weight-bearing and could not walk or stand on both legs. The patient had maintained the ability to perform limited activities by controlling his pain through narcotics. No limb shortening and no deformities were found. Neuromuscular and vascular examination in both lower extremities were remarkable. In the plain pelvic radiography, bilateral femoral neck fractures (Pauwels classification: Type III on both sides) were observed (Fig. 3).

Similar to the first case, laboratory tests showed no signs of any underlying metabolic or endocrine disorders impacting bone health. According to the patient's activity following analgesia (although limited) and no DVT-related signs or symptoms, the blood level of D-dimer was checked preoperatively, which was negative. For the same reasons as case 1, bipolar hemiarthroplasty was considered for the patient. One-staged cementless bipolar hemiarthroplasty surgery technique was used to replace femur heads on both sides (Fig. 4). The second side was prepared and draped after completing the first side surgery. A senior surgeon performed the surgery. Twenty-four hours after the surgery, the patient moved his legs slightly on the horizontal surface without discomfort. In 16 months of follow-up, he started to recover and began weight-bearing gradually until he returned to his everyday life (Hip Harris score: 89.00).

3. Discussion

Simultaneous bilateral femoral neck fractures are rare. These fractures have been linked to various factors, including high and low-energy traumas, electroconvulsive therapy, chronic kidney disease, and corticosteroid use. Additionally, conditions such as abnormal anatomy, Graves' disease, renal osteodystrophy, seizures, pregnancy, and narcotic drug abuse can contribute to their occurrence. Other causes include high-voltage electrical injuries and bone diseases like osteoporosis and osteomalacia [3,7,14–24]. We reported two patients with narcotic drug addiction and low socioeconomic status who were diagnosed with neglected simultaneous bilateral femoral neck fractures. Patient 1 had a car accident 40 days earlier, and pelvic radiography revealed no fracture immediately post-trauma. Pelvic radiograph showed bilateral femoral neck fractures 40 days after the accident. The second patient was diagnosed with bilateral femoral neck fractures 35 days after lifting a heavy load. There is an increasing possibility for the presence of insufficiency or fatigue fractures in the femoral neck of a patient with addiction [3] and low socioeconomic status, so there is always a chance that a low-energy trauma from sideways or straight down falling to a high-energy trauma like a car accidents would result in a severe injury like simultaneous bilateral femoral neck fractures. Patients with narcotic addiction alleviate their severe pain by increasing the consumption of the drugs, and almost many symptoms are masked as a result. So, there is a high chance of neglected fractures in these cases.

The strength of our report is its rarity, offering valuable insights into the clinical presentation, diagnostic strategies, and management considerations for neglected simultaneous bilateral femoral neck fractures. However, the study's limitations include its retrospective design, and the

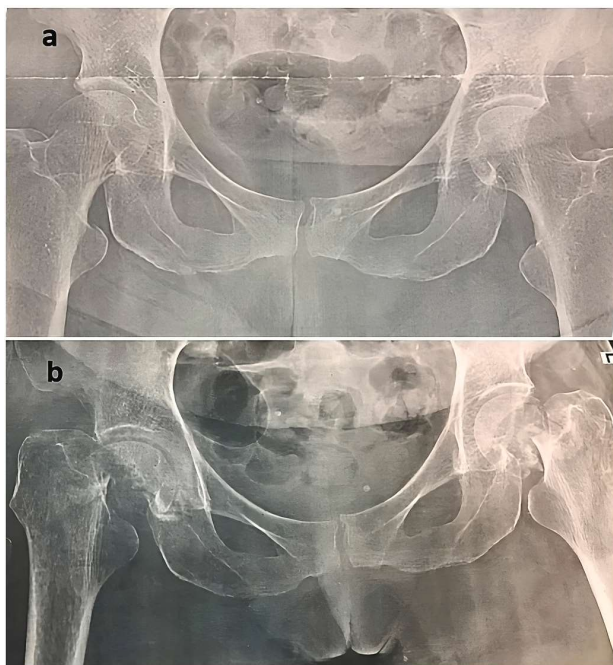


Fig. 1. (a) Radiograph taken on the same day of the accident, 40 days before the admission (b) Radiograph taken on the day of the admission, 40 days after the accident.

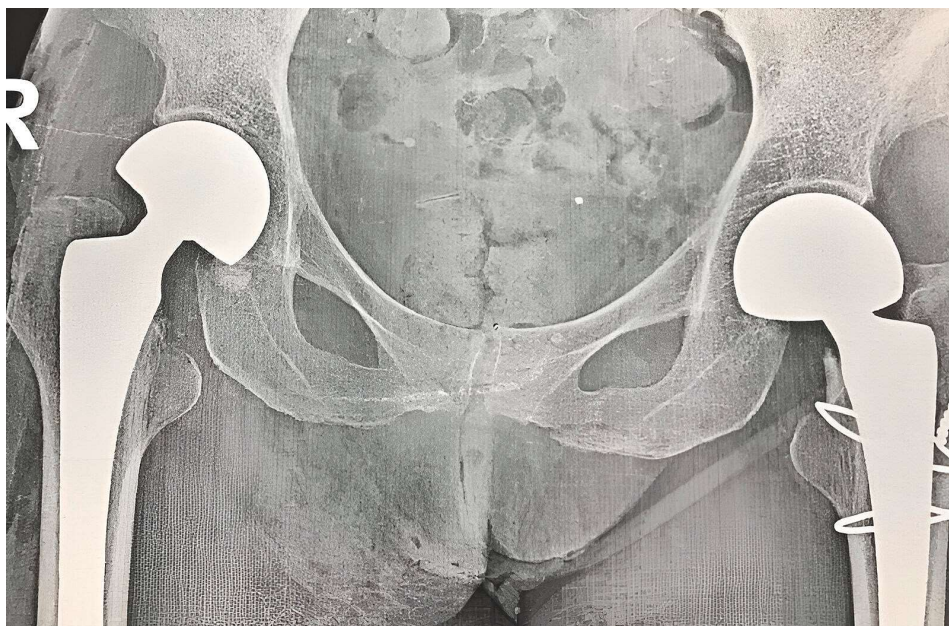


Fig. 2. Radiograph after the operation, bilateral cementless bipolar hemiarthroplasty.

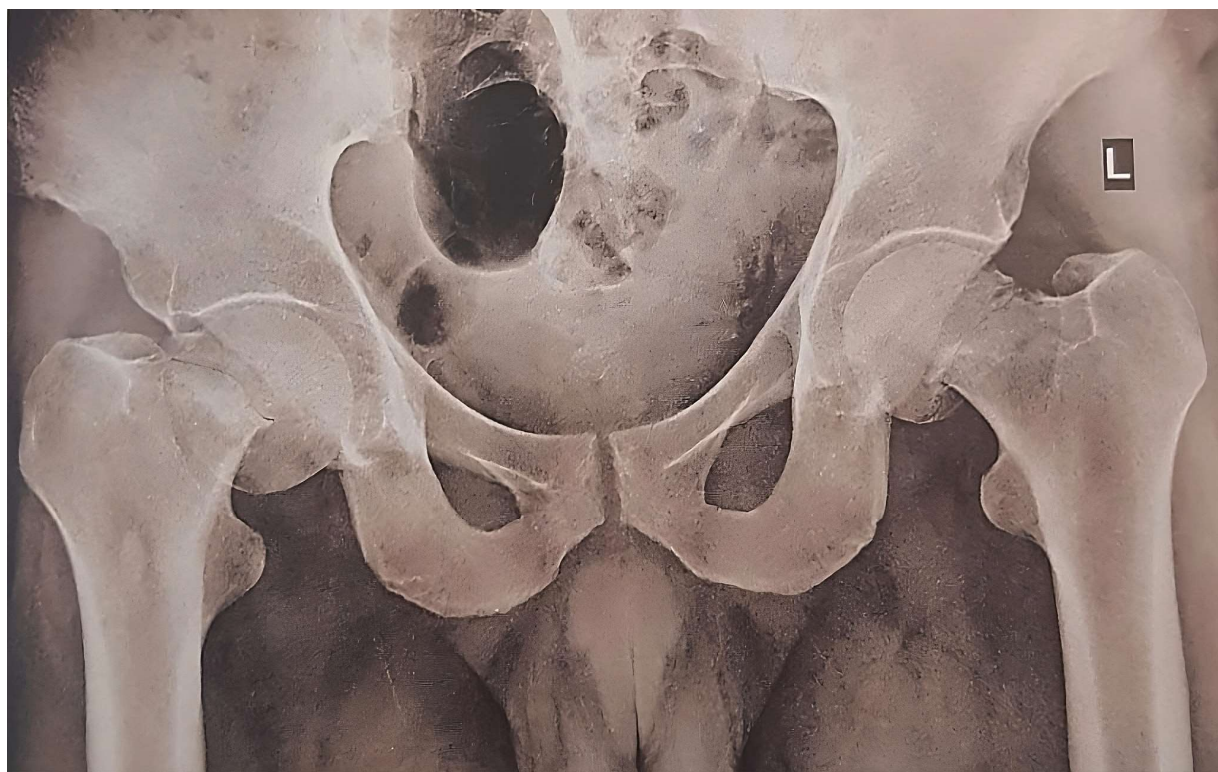


Fig. 3. Radiograph taken before operation demonstrates displaced bilateral femoral neck fractures.

nature of being a case report, which limit the generalizability of the findings. Short-term follow-up (14 to 16 months) limits assessment of long-term outcomes and potential complications.

Through a literature review, we found 12 case reports (see [Table 1](#)) of neglected simultaneous bilateral femoral neck fractures, including 17

patients [2,3,7–10,24–29]. Gupta et al. [28] reported a 10-year-old girl with vitamin D deficiency who fell from the bed, resulting in one month of hip pain, and was finally diagnosed with neglected simultaneous bilateral femoral neck fractures. Pandey et al. [29] reported a 13-year-old girl with vitamin D deficiency, no trauma, and six months of hip

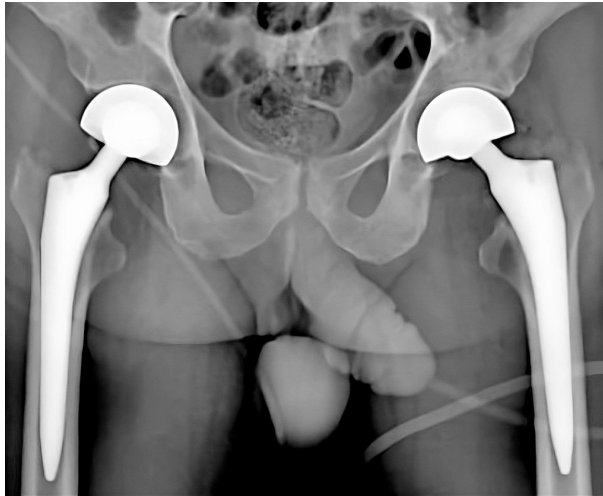


Fig. 4. Radiograph was taken after the operation, cementless bipolar hemiarthroplasty.

pain with the same diagnosis. Underlying causes in adult patients with neglected simultaneous bilateral femoral neck fractures included End-stage renal disease ($n = 2$), vitamin D deficiency ($n = 2$), pregnancy ($n = 2$), hyperparathyroidism ($n = 2$), seizure ($n = 2$), trauma ($n = 8$), and narcotic drug addiction ($n = 1$) [2,3,7–10,24–27]. Grave's disease ($n = 1$) and metastatic bone disease ($n = 1$) were also reported [2,24]. Neglecting time varied from 25 days to one and a half years [2,9], and neglecting causes included the patient's low socioeconomic status, missed diagnoses by the medical team, narcotic drug addiction, and the distance from the medical center [2,3,10,28].

The treatment of neglected femoral neck fractures typically depends on factors such as the patient's age, overall physical condition, viability of the femoral head, extent of neck resorption, and duration of nonunion [1,4]. Several surgical approaches have been employed in the management of neglected simultaneous bilateral femoral neck fractures, with varying techniques tailored to patient-specific factors such as age and severity of the fractures. The outcomes of these interventions have shown a wide range of results (Table 1).

Pandey et al. [29] reported on a 13-year-old female who underwent bilateral valgus osteotomy and fixation with a dynamic hip screw after six months of neglect. The outcome was complicated by one-sided nonunion at ten months, which was successfully managed with a longer dynamic hip screw, and no complications were observed at six

Table 1
Review of published cases with neglected simultaneous bilateral femoral neck fractures.

Author, year	Age (y)	Gender	Symptoms duration	Underlying causes	Surgical management	Complications/outcomes
Pandey et al. [1], 2023	13	Female	Six months	Vitamin D deficiency, no trauma	Bilateral valgus osteotomy and fixation with a dynamic hip screw	One-sided nonunion at ten months follow-up, managed by longer dynamic hip screw, none at six months follow-up
Rednah et al. [2], 2023	37	Female	Two months	End-stage renal disease, simple fall on her side	Two-stage bilateral total hip arthroplasty	None at two years follow-up
Gupta et al. [3], 2022	10	Female	One month	Vitamin D deficiency, fall from bed	Cannulated cancellous screw fixation in the right hip and valgus osteotomy in the left hip	Right-sided non-union at five months, managed by valgus osteotomy and external fixator, none at ten years follow-up
Sakale et al. [4], 2022	70	Male	One month	Grave's disease, vitamin D deficiency, no trauma	None	NM
Dhahri et al. [5], 2022	31	Male	Two months	Seizure, no trauma	Two-stage hemiarthroplasty (Bipolar)	None at one-month follow-up
Fukui et al. [6], 2019	55	Male	One month	Osteoporosis and vitamin D deficiency osteomalacia, no trauma	Bilateral internal fixation with cannulated screw	None at one-year follow-up
Hafez et al. [7], 2016	52	Male	One year	Trauma	NM	Fusion with bilateral: Girdle stone
Hafez et al. [7], 2016	60	Male	One and half year	Trauma, Diabetes	No	Pressure sores, death at three months
Hafez et al. [7], 2016	60	Male	One and half month	Trauma	Total hip arthroplasty	Walks with stick
Hafez et al. [7], 2016	62	Female	One and half month	Metastatic bone disease	No	Painful hip, inability to walk
Hafez et al. [7], 2016	64	Male	Several months	Trauma	Dynamic hip screw for left and hemiarthroplasty for right	Poor function and inability to walk due to nonunion of fracture of left and failed right hemiarthroplasty
Hafez et al. [7], 2016	30	Female	Two months	Secondary hyperparathyroidism, no trauma	Cannulated screws in both hips and osteotomy with blade plate	Bilateral non-union, managed by total hip arthroplasty that failed, no weight bearing at two years follow-up
Kalender et al. [8], 2010	33	Female	Twenty-five days	Pregnancy, primary hyperparathyroidism, no trauma	Closed reduction and internal fixation with cannulated lag screws under C-arm fluoroscopy	None at two years follow-up
Hootkani et al. [9], 2010	28	Male	Eight months	Narcotic addiction, no trauma	One-staged bilateral hip hemiarthroplasty	None at six months follow-up
Magu et al. [10], 2009	31	Female	One month	Pregnancy, seizure, and fall from bed	Two-staged bilateral valgus intertrochanteric osteotomy	None at four years follow-up
Hung et al. [11], 2001	39	Female	One month	End-stage renal disease, fall three years ago	Two-staged bilateral hip hemiarthroplasty	None at three years follow-up
Annan et al. [12], 1986	29	Female	Two months	Abnormal anatomy, no trauma	Bilateral subtrochanteric valgus osteotomies	None at six months follow-up
Current study	65	Female	Forty days	Narcotic addiction, car accident 40 days ago	One-stage bilateral hip hemiarthroplasty (bipolar)	None at 14 months follow-up
Current study	45	Male	One month	Narcotic addiction, no trauma	One-stage bilateral hip hemiarthroplasty (bipolar)	None at 16 months follow-up

months follow-up. Similarly, Gupta et al. [28] described a 10-year-old female managed with cannulated cancellous screw fixation in one hip and valgus osteotomy in the other following one month of neglect. This case also presented with a right-sided nonunion at five months, managed by valgus osteotomy and external fixator, with no further complications at a ten-year follow-up. Rednah et al. [8] and Dhahri et al. [27] utilized two-stage total and hemiarthroplasty, respectively, for their patients, with no complications reported at long-term follow-ups of two years and one month, respectively, following two-month periods of neglect in both cases. Hootkani et al. [3] and Hung et al. [7] also employed hemiarthroplasty in a one-stage and two-stage procedure, respectively, with no complications reported at six months and three years of follow-up, respectively, after eight months and one month of neglect.

Kalender et al. [9] reported a case managed with closed reduction and internal fixation using cannulated lag screws under C-arm fluoroscopy, showing no complications at two years follow-up following 25 days of neglect. Magu et al. [26] described a two-staged bilateral valgus intertrochanteric osteotomy with no complications at four four-year follow-ups after one month of neglect. Hafez et al. [2] presented several cases with mixed outcomes. One 64-year-old male underwent dynamic hip screw fixation for one hip and hemiarthroplasty for the other, resulting in poor function and inability to walk due to nonunion and failed hemiarthroplasty following several months of neglect. Another case involved a 30-year-old female managed with cannulated screws and osteotomy with a blade plate, resulting in bilateral nonunion and subsequent total hip arthroplasty, which failed, leading to no weight bearing at two years follow-up after two months of neglect.

In our study, both patients were managed with one-stage bilateral hip hemiarthroplasty (bipolar), and no complications were reported at 14 and 16 months of follow-up, respectively. This aligns with the favorable outcomes reported in other studies utilizing hemiarthroplasty and different surgical techniques, demonstrating effective management and minimal complications. However, the diversity in surgical approaches and outcomes in the literature underscores the necessity for individualized treatment plans based on patient-specific factors and the complexity of bilateral femoral neck fractures.

4. Conclusion

In conclusion, our study highlights the challenging management of neglected simultaneous bilateral femoral neck fractures, particularly in patients with narcotic addiction and socioeconomic constraints. Through detailed case presentations and a comprehensive literature review, we underscored the rarity of these fractures and the diverse treatment approaches employed globally. The favorable outcomes observed in our cases following one-stage bilateral hip hemiarthroplasty support its efficacy in restoring function and minimizing complications, aligning with similar reports in the literature. The diverse outcomes associated with different surgical techniques highlight the importance of customizing treatment strategies to individual patient characteristics and fracture severity. Additional research and larger studies are needed to develop standardized protocols and improve outcomes for this challenging clinical situation.

Consent

Written informed consent was obtained from the patients for publication of this case report and accompanying images. A copy of the written consents are available for review by the Editor-in-Chief of this journal on request.

Ethical approval

Ethical approval for this case report was not required as per the policies of the Ethics Committee of Alborz University of Medical Sciences. According to the institutional guidelines, case reports are

considered exempt from ethical approval as they do not constitute research involving systematic investigation. This policy is in alignment with the guidelines of the Ethics Committee of Alborz University of Medical Sciences (IR.NREC.013.1395.12).

Funding

None.

Author contribution

Najafi Arvin: Conceptualization, Data Curation, Supervision. Azarsina Salman: Conceptualization, Data curation, Writing- Original draft preparation. Hadavi Dorsa: Data curation, Writing- Original draft preparation. Arkian Rahele: Data curation, Writing- Original draft preparation. Sevak Hatamian: Writing- Reviewing and Editing, Data curation. Chaghmirzayi Pouria: Writing- Reviewing and Editing, Project administration, Software.

Guarantor

Pouria Chaghmirzayi, M.D.

Research registration number

None.

Conflict of interest statement

The authors declare that they have no competing interests.

Data availability

All data generated or analyzed during this study are included in this published article (available).

Acknowledgments

We acknowledge the Clinical Research Development Unit of Shahid Madani Hospital, Alborz University of Medical Science, Karaj, Iran, for their support. This research received no funding.

References

- [1] A.K. Jain, R. Mukunth, A. Srivastava, Treatment of neglected femoral neck fracture, *Indian J. Orthop.* 49 (1) (2015) 17–27, <https://doi.org/10.4103/0019-5413.143909>.
- [2] M. Hafez, F. Sadek, H. Hamza, A. Al-Dars, Outcome of bilateral simultaneous fracture neck of femur in patients with low socioeconomic status, *Trauma Cases Rev.* 2 (2016) 038.
- [3] A. Hootkani, A. Moradi, E. Vahedi, Neglected simultaneous bilateral femoral neck fractures secondary to narcotic drug abuse treated by bilateral one-staged hemiarthroplasty: a case report, *J. Orthop. Surg. Res.* 5 (2010) 41, <https://doi.org/10.1186/1749-799x-5-41>.
- [4] A.C. Agrawal, Neglected fracture neck of femur: our experience, *J. Orthop. Dis. Traumatol.* 1 (1) (2018) 21–22, <https://doi.org/10.4103/jodp.JODP.9.18>.
- [5] A. Roshan, S. Ram, The neglected femoral neck fracture in young adults: review of a challenging problem, *Clin. Med. Res.* 6 (1) (2008) 33–39, <https://doi.org/10.3121/cm.2008.752>.
- [6] N.P. McGoldrick, M.K. Dodds, C. Green, K. Synnott, Management of simultaneous bilateral neck of femur fractures in an elderly patient, *Geriatr. Orthop. Surg. Rehabil.* 4 (3) (2013) 71–73, <https://doi.org/10.1177/2151458513511626>.
- [7] K.H. Hung, C.T. Lee, Y.L. Gau, J.B. Chen, Neglected bilateral femoral neck fractures in a patient with end-stage renal disease before chronic dialysis, *Ren. Fail.* 23 (6) (2001) 827–831, <https://doi.org/10.1081/jdi-100108194>.
- [8] D. Rednah, O.S. Brinji, M. Aldakhil, E. Alshareef, M. Alshehri, Surgical challenge in the management of spontaneous, bilateral, nontraumatic, neglected femoral neck fractures in a patient with end-stage renal disease: a case report and literature review, *Cureus* 15 (5) (2023) e38633, <https://doi.org/10.7759/cureus.38633>.
- [9] A.M. Kalender, A. Dogan, A. Cakar, T. Turkoz, Neglected bilateral femoral neck fracture associated with pregnancy and primary hyperparathyroidism, *Acta Orthop. Belg.* 76 (4) (2010) 559–563.

- [10] K. Fukui, A. Kanenji, H. Hirata, J.I. Tsujioka, A. Shioya, S. Yamada, et al., Bilateral spontaneous simultaneous femoral neck occult fracture in a middle-aged man due to osteoporosis and vitamin D deficiency osteomalacia: a case report and literature review, *Int. J. Surg. Case Rep.* 60 (2019) 358–362, <https://doi.org/10.1016/j.ijscr.2019.06.058>.
- [11] I.S. Moghamis, A. Mudawi, E. Babikir, M.H.E. Elamin, M.A. Samhadaneh, S. A. Hameed, Bilateral femoral neck fracture following a convulsion in the presence of chronic kidney disease. A case report, *Int. J. Surg. Case Rep.* 89 (2021) 106545, <https://doi.org/10.1016/j.ijscr.2021.106545>.
- [12] K. Moerenhout, G. Gkagkalis, G.Y. Laflamme, D.M. Rouleau, S. Leduc, B. Benoit, Total hip arthroplasty for bilateral femoral neck stress fracture: a case report and review of the literature, *Adv. Orthop.* 2019 (2019) 2720736, <https://doi.org/10.1155/2019/2720736>.
- [13] C. Sohrabi, G. Mathew, N. Maria, A. Kerwan, T. Franchi, R.A. Agha, The SCARE 2023 guideline: updating consensus surgical CAsE REport (SCARE) guidelines, *Int. J. Surg.* 109 (5) (2023) 1136–1140.
- [14] A. Sood, C. Rao, I. Holloway, Bilateral femoral neck fractures in an adult male following minimal trauma after a simple mechanical fall: a case report, *Cases J.* 2 (1) (2009) 92, <https://doi.org/10.1186/1757-1626-2-92>.
- [15] G.S. Tompkins, R.C. Henderson, H.D. Peterson, Bilateral simultaneous fractures of the femoral neck: case report, *J. Trauma* 30 (11) (1990) 1415–1416, <https://doi.org/10.1097/00005373-199011000-00020>.
- [16] I.H. Annan, R.A. Buxton, Bilateral stress fractures of the femoral neck associated with abnormal anatomy—a case report, *Injury* 17 (3) (1986) 164–166, [https://doi.org/10.1016/0020-1383\(86\)90323-2](https://doi.org/10.1016/0020-1383(86)90323-2).
- [17] J. Schröder, R.K. Marti, Simultaneous bilateral femoral neck fractures: case report, *Swiss Surg.* 7 (5) (2001) 222–224, <https://doi.org/10.1024/1023-9332.7.5.222>.
- [18] S. Gurdezi, R.K. Trehan, M. Rickman, Bilateral undisplaced insufficiency neck of femur fractures associated with short-term steroid use: a case report, *J Med Case Reports* 2 (2008) 79, <https://doi.org/10.1186/1752-1947-2-79>.
- [19] L. Maramreddy, R. Mittal, A. Anand, P. Vatsya, Bilateral nonunion of femoral neck fractures because of nutritional osteomalacia: a report of 2 cases, *JBJS Case Connect.* 12 (4) (2022) e22.00314, <https://doi.org/10.2106/jbjs.Cc.22.00314>.
- [20] S. Siva, Q. Liao, A. Abbas, K. Periasamy, Bilateral atraumatic femoral neck fractures resulting from transient osteoporosis of the hip, *BMJ Case Rep.* 15 (10) (2022) 10.1136/bcr-2021-247967.
- [21] H.D. Powell, Simultaneous bilateral fractures of the neck of the femur, *J. Bone Joint Surg. Br.* 42-b (1960) 236–252, <https://doi.org/10.1302/0301-620x.42b2.236>.
- [22] R. John, P. Kumar, S. Aggarwal, R.K. Rajnish, S. Agarwal, K. Vatsyan, Simultaneous, non-traumatic, bilateral neck femur fractures in uremic renal osteodystrophy: a report of three cases and literature review, *J. Orthop. Case Rep.* 8 (2) (2018) 90–94, <https://doi.org/10.13107/jocr.2250-0685.1066>.
- [23] D.G. Maimin, L. Meneses-Turino, Seizures causing simultaneous bilateral neck of femur fractures, *Case Rep. Orthop.* 2019 (2019) 4570578, <https://doi.org/10.1155/2019/4570578>.
- [24] H. Sakale, S.K. Yadav, B.K. Kar, S. Kowshik, A.C. Agrawal, R. Ranjan, Pathological fractures of bilateral neck of femur in geriatric population: our experience and review of literature, *J. Orthop. Case Rep.* 12 (6) (2022) 1–4, <https://doi.org/10.13107/jocr.2022.v12.i06.2840>.
- [25] I. Annan, R. Buxton, Bilateral stress fractures of the femoral neck associated with abnormal anatomy—a case report, *Injury* 17 (3) (1986) 164–166.
- [26] N.K. Magu, R. Rohilla, A. Gulia, R. Singh, Valgus intertrochanteric osteotomy in neglected simultaneous, bilateral, displaced subcapital femoral neck fractures in an epileptic pregnant woman, *Curr. Orthop. Pract.* 20 (4) (2009) 467–469.
- [27] F.A. Dhahri, Y. Alsahafy, Bilateral simultaneous femoral neck fractures secondary to epileptic seizure: case report, *Egypt. J. Hosp. Med.* 88 (1) (2022) 3746–3748.
- [28] A.K. Gupta, A. Narang, S. Gupta, R.K. Kanojia, Bilateral neck of femur fracture in a child with underlying vitamin D deficiency: a case report on management and 10-year follow-up, *Cureus* 14 (3) (2022) e22953, <https://doi.org/10.7759/cureus.22953>.
- [29] R.A. Pandey, L. Garg, Bilateral non-traumatic neglected femoral neck fracture in a healthy adolescent: a case report and review of literature, *J. Orthop. Case Rep.* 13 (10) (2023) 105–110, <https://doi.org/10.13107/jocr.2023.v13.i10.3954>.