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Penetrating cardiac injury after percutaneous breast core-needle biopsy, unusual life-threatening complication: a case report

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Abstract

Background Complications after percutaneous breast biopsy are infrequent but may include hematoma, pseudoaneurysm formation, persistent pain, infection, delayed wound healing, vasovagal reaction, hemothorax, pneumothorax, and neoplastic seeding. The risk factors include tumor factors (size, location, vascularity), procedure-related factors (needle diameter, number of biopsies), and interventionist experience. There has been no previous report of a fatal complication resulting from percutaneous breast biopsy.

Case presentation We report a 54-year-old Asian woman with a 3 cm BI-RADS® 4B left breast mass in the lower-inner quadrant who was biopsied by a 16 G needle under ultrasound guidance at a province hospital. She experienced dizziness and near-syncope afterward. The initial evaluation showed evidence of cardiac tamponade with hemodynamic instability. She underwent urgent subxiphoid pericardial window and was transferred to our facility. We brought her directly to the operating room to perform an explorative median sternotomy and found a 0.2 cm hole in the right ventricle. The injured site was successfully repaired without cardiopulmonary bypass. Postoperative echocardiography demonstrated mild right ventricular dysfunction without evidence of septal or valvular injury. She survived with no significant complications.

Discussion This case might be the first report of a life-threatening complication related to percutaneous breast core-needle biopsy. The rapid pericardial release is key to the survival of cardiac tamponade. The patient subsequently required cardiac repair and monitoring to avoid long-term complications. In this report, we suggested a safe biopsy method, complications recognition, and appropriate management of penetrating cardiac injury.

Conclusion Penetrating cardiac injury resulting from percutaneous breast biopsy is extremely rare but can occur. A biopsy must be done cautiously, and worst-case management should promptly be considered.

Keywords Penetrating cardiac injury, Percutaneous breast biopsy, Cardiac tamponade, Complication, Case report

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Background

Percutaneous breast core-needle biopsy is the current standard method for diagnosing breast tumors. It has replaced open biopsy in terms of lower invasiveness, adequate tissue sampling, good cost-effectiveness, better cosmetic, and good patient recovery [1]. Complications of this procedure are usually mild and do not require surgical intervention. Some severe complications, such as sizable hematoma, pseudoaneurysm formation, or pneumothorax, may occur. However, there was no previous mention of cardiac injury related to this procedure.

Case profile

A healthy 54-year-old Asian woman presented with a palpable left breast mass for 2 months. She came to the outpatient department of a province hospital and underwent a mammography. The mammography showed a 3 cm ill-defined hyperdense mass in the left lower-inner quadrant without suspicious calcifications or secondary changes, consistent with the BI-RADS® 4B category (Fig. 1). She was scheduled for an ultrasound-guided percutaneous core-needle biopsy. A 16 G needle (UNIGUN™) was used. A small incision was made over the mass, and the needle was inserted against the mass. However, the ultrasound field lost the needle tip during firing. The patient complained of severe pain immediately after firing. She also had chest discomfort, diaphoresis, and fainting within 10 minutes after. The vital signs were respiration rate (R) 28 breaths per minute, heart rate (P) 70 bpm, and blood pressure (BP) 54/36 mmHg with a SpO_2 of 97%.

She was resuscitated with two liters of warm saline solution and was intubated immediately. The focused assessment with sonography for trauma (FAST) revealed a 2 cm hyperechoic fluid thickness in the pericardium, likely hemopericardium (Fig. 2). She was diagnosed with cardiac tamponade and then was brought to the operating room (OR) for release with a subxiphoid

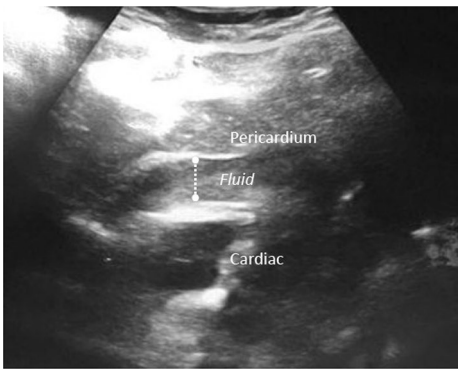

Fig. 2 Cardiac ultrasound

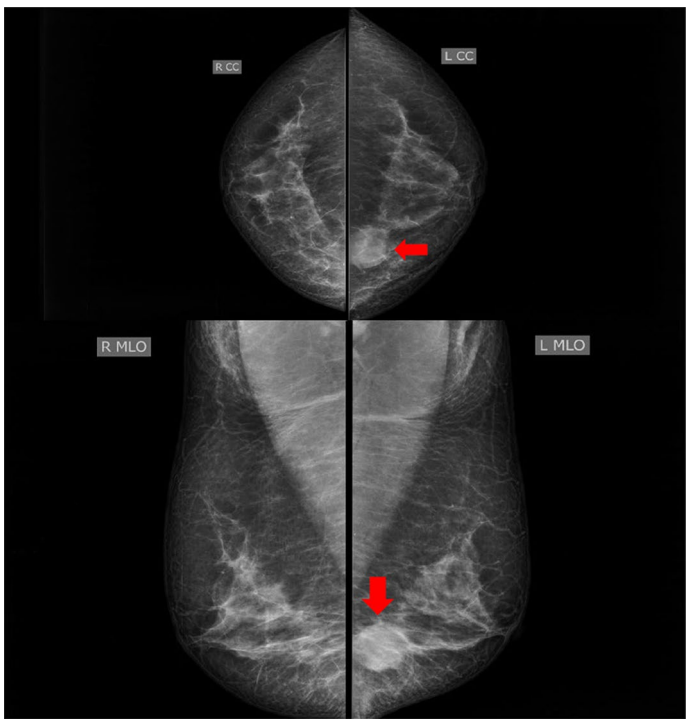

Fig. 1 Mammography demonstrating a 3 cm mass in the left breast (red arrow).*R* right, *L* left, *CC* craniocaudal view, *MLO* mediolateral oblique view

pericardial window. A 300 ml blood clot was drained, and her vitals rapidly improved. The primary surgeon could not perform definitive repair, so she was referred to our facility (10 km away). Per our institute guidelines, she was transferred to the OR without additional imaging. The intraoperative vital signs were P 72 bpm and BP 160/100 mmHg with a SpO_2 of 100% (FiO_2 1.0). There was no active bleeding from the pericardial drain (total 250 ml) with no inotrope. The initial Hb was 10.2 g/dl.

The explorative median sternotomy was performed without cardiopulmonary bypass (CPB). We found 100 ml of clot retention in the pericardium with a 0.2 cm hole in the right ventricle (RV). The injured site did not involve the coronary arteries and did not actively bleed, consistent with American Association for the Surgery of Trauma (AAST) grade IV (Fig. 3). The intraoperative cardiac monitoring showed no significant arrhythmia with a CVP of 15 mmHg. The arterial pH was 7.3, with a serum lactate of 3.5 mmol/l. The cardiac wound was primarily repaired with an interrupted 3–0 polypropylene suture in the figure-of-eight technique. The clot was removed, and the pericardial sac was irrigated with a warm saline solution. A 28F chest tube was inserted as a pericardial drain. The pericardium was fully re-approximated, and the sternum and chest wall were closed. The patient was transferred to the intensive care unit (ICU) with no inotropic drugs.

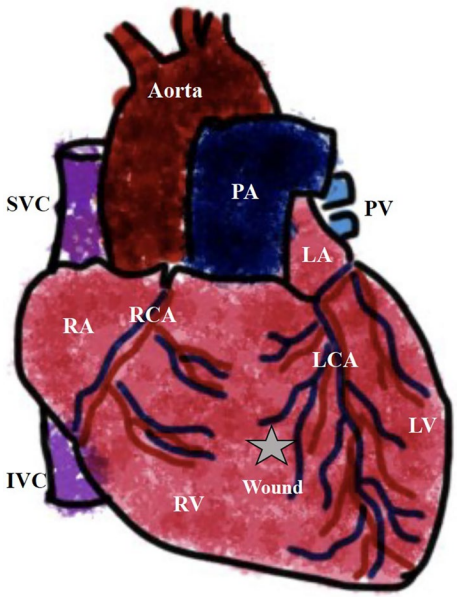

Fig. 3 Scheme of the injury site (star). *SVC* superior vena cava, *IVC* inferior vena cava, *RA* right atrium, *RCA* right coronary artery, *RV* right ventricle, *PA* pulmonary artery, *LA* left atrium, *LCA* left coronary artery, *PV* pulmonary vein, *LV* left ventricle. This is the author's work and permit for use

The postoperative bedside echocardiography revealed preserved left ventricular ejection function (LVEF) with an estimated LVEF of 70%, mild RV systolic dysfunction, a 0.2 cm pericardial fluid thickness with no signs of physiologic tamponade, and no evidence of septal or valvular injury. The cardiac troponin-T level mildly increased (0.718 ng/dl) 6 hours after the operation with an ST segment elevation in I, II, III, aVL, aVF, and V2–6 leads. The patient was diagnosed with postoperative pericarditis and treated with nonsteroidal antiinflammatory drugs (NSAIDs). The pericardial drain was removed postoperatively on day 2. She was recovering well with no significant cardiac complications and was referred back to the primary province hospital on postoperative day 4. Her breast tumor was rescheduled for evaluation after recovery from this injury.

Discussion

The percutaneous ultrasound-guided core-needle breast biopsy has been classified as a low-risk procedure 2. The complications of percutaneous breast biopsy included bleeding, hematoma, pseudoaneurysm formation, persistent pain, infection, delayed wound healing, vasovagal reaction, hemothorax, pneumothorax, and neoplastic seeding [3–6]. Ultrasound-guided needle biopsy of the breast can be performed with spring-loaded needles (12–18 G) or vacuum-assisted needles (10–12 G) [3]. The factors associated with developing complications include tumor size, location, vascularity, needle gauge, amount of sampling tissue, and interventionist experience [5, 6].

This breast mass was located in the deep, low breast volume position and close to the chest wall, which may increase the risk of complications. We suggest the tips and techniques of core-needle biopsy in this position must include:

1 Increasing the distance between the mass and the skin opening to decrease the needle–skin angle
2 Injecting the local anesthesia beneath the mass to increase space from the chest wall
3 Placing the downward needle direction parallel to the skin before firing
4 Locating the needle tip at the mass border or about 1 cm in front of the border to avoid through-and-through cutting significantly in the small-sized mass
5 Understanding the penetration depth of each instrument and keeping the distance between the needle tip and chest wall more than the penetration depth
6 Always keeping the whole needle visible before and during firing

The patient should be informed that this procedure involves a loud noise during the biopsy and should be shown the actual noise to avoid unintentional moves. Pillows must elevate the ipsilateral shoulder and back to increase the inner breast tissue thickness, which makes firing safer.

Penetrating cardiac injury (PCI) is one of the fatality chest injuries with a mortality rate of 16–43% [7]. However, the incidence of PCI is very low (< 1%), which leads to unfamiliar trauma management [8]. Early mortality related to PCI resulted from exsanguination, cardiac failure, or cardiac tamponade. Cardiac tamponade is the most common presentation of PCI and may have a high chance of survival if promptly diagnosed and released [9]. The diagnosis of cardiac tamponade can be made by classic clinical presentation (Beck's triad), cardiac ultrasonography (FAST or echocardiography), or chest computed tomography. Rapid pericardial release with pericardiocentesis and subxiphoid pericardial window are still debated. However, most of the recent studies preferred a subxiphoid pericardial window in life-threatening cases or in places that cannot mandate median sternotomy [9–14].

Our case was diagnosed with PCI and cardiac tamponade by clinical presentation of obstructive shock and pericardial effusion on the FAST examination. The primary general surgeon decided to perform an emergent subxiphoid pericardial window. This action is appropriate and become a life-saving procedure. In Thailand, there is still a need for cardiothoracic surgeons. We suggest teaching the subxiphoid pericardial window to all general surgical residents, which should be considered an essential procedure before completing the training. A cadaveric workshop or animal model may be required. Familiarity with this procedure might increase survival in patients with PCI.

The current evidence recommends early surgical interventions as the mainstay treatment of PCI [10–14]. The previous studies preferred a median sternotomy approach in PCI with optimum hemodynamics to allow better visualization and good results. In contrast, left anterolateral thoracotomy (referred to as resuscitative thoracotomy) is usually utilized in extreme PCI cases [9–14]. The use of CPB during repair should be considered in substantial cardiac dysfunction, arrhythmia, or impending cardiac failure caused by PCI (usually occurring with coronary or valvular injuries), sizeable cardiac wound, difficult-to-assess locations, or failure to repair. The suggested ventricle repair technique included figure-of-eight stitches with 3–0 polypropylene sutures or pledged polypropylene sutures with a horizontal mattress technique in a simple laceration. Placing interrupted horizontal mattresses deep beneath the coronary bed must be considered in injuries adjacent to coronary arteries [14].

A small hole in the right ventricle with no active bleeding was notable in this case. The on-call trauma surgeon performed the cardiorrhaphy without CPB and selected small-bite figure-of-eight stitches with a 3–0 polypropylene suture (no pledged) for repairing this wound. This stitch did not involve the left coronary artery, even though the wound was quite close to the vessel. The pumping heart was the troubleshot of this procedure. However, the confidence in inserting the needle in the diastole phase might be helpful. Full-thickness repair should be attempted in the first bite. It became easier if the first bite was successful. Our suggested technique was gently pulling up the first sutures to approximate the wound edge and reinserting the second shot across the first bite. Pledged suture may not required in this wound. Cardiac arrhythmia should be considered after stitches. Fortunately, this case had no significant fatal arrhythmia. We suggested an intraoperative transesophageal echocardiography (TEE) to visualize internal cardiac structures and estimate cardiac function. We did not perform TEE in this case owing to availability. However, postoperative transthoracic echocardiography was performed in the ICU. This case developed mild post-pericardiotomy syndrome within the first 24 hours after surgery. This complication was treated with NSAIDs. She survived with no early cardiac sequelae.

Conclusion

This case might be the first report of PCI following a percutaneous breast core-needle biopsy. This complication may be infrequent, but it is a fatality. Careful breast biopsy and prompt diagnosis of fatal complications must be considered. Rapid pericardial releasing procedures should be implemented in surgical training curriculums, especially the subxiphoid pericardial window. Directing to the OR protocol and gentle cardiorrhaphy might improve the outcomes.

Abbreviations

BI-RADS®	Breast imaging report and data system
FAST	Focused assessment with sonography for trauma
CPB	Cardiopulmonary bypass
RV	Right ventricle
AAST	The American Association for the Surgery of Trauma
CVP	Central venous pressure
ICU	Intensive care unit
LVEF	Left ventricular ejection function
NSAIDs	Nonsteroidal antiinflammatory drugs
PCI	Penetrating cardiac injury
TEE	Transesophageal echocardiography
OR	Operating room

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Author contributions
AK contributed to the literature search, draft writing, critical revision, and final approval of the final version for submission. SS and WL contributed to critical revision and draft writing.

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Availability of data and material
The data supporting this study's findings are available from Thammasat University Hospital. However, restrictions apply to the availability of these data, which were used under license for the current study and are not publicly available. Data are, however, available from the authors upon reasonable request and with permission of the Faculty of Medicine, Thammasat University, and the Thammasat University Hospital.

Declarations

Ethical approval and consent to participants
Not applicable.

Consent for publication
Written informed consent was obtained from the patient to publish this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests
The authors declare that they have no competing interests.

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References

1. Levin DC, Parker L, Schwartz GF, *et al*. Percutaneous needle vs surgical breast biopsy: previous allegations of overuse of surgery are in error. J Am Coll Radiol. 2012;9(2):137–40.
2. Patel IJ, Rahim S, Davidson JC, *et al*. Society of interventional radiology consensus guidelines for the periprocedural management of thrombotic and bleeding risk in patients undergoing percutaneous image-guided interventions-part II: recommendations. J Vasc Interv Radiol. 2019;30(8):1168–84.
3. Lewis JD, Groszkiewicz A, Hefelfinger L, *et al*. Clinically significant bleeding complications of percutaneous breast biopsy: 10-year analysis and a proposed management algorithm. Clin Imaging. 2023;104: 110017.
4. Simon JR, Kalbhen CL, Cooper RA, *et al*. Accuracy and complication rates of US-guided vacuum-assisted core breast biopsy: initial results. Radiology. 2000;215(3):694–7.
5. Bick U, Trimboli RM, Athanasiou A, *et al*. Image-guided breast biopsy and localisation: recommendations for information to women and referring physicians by the European Society of Breast Imaging. Insights Imaging. 2020;11(1):12.
6. Dahabreh IJ, Wieland LS, Adam GP, et al. Core Needle and Open Surgical Biopsy for Diagnosis of Breast Lesions: An Update to the 2009 Report. AHRQ Comparative Effectiveness Reviews. Rockville (MD) 2014.
7. Degiannis E, Loogna P, Doll D, *et al*. Penetrating cardiac injuries: recent experience in South Africa. World J Surg. 2006;30(7):1258–64.
8. Lustenberger T, Talving P, Lam L, *et al*. Penetrating cardiac trauma in adolescents: a rare injury with excessive mortality. J Pediatr Surg. 2013;48(4):745–9.
9. Rahim Khan HA, Gilani JA, Pervez MB, *et al*. Penetrating cardiac trauma: a retrospective case series from Karachi. J Pak Med Assoc. 2018;68(8):1285–7.
10. Mishra B, Gupta A, Sagar S, *et al*. Traumatic cardiac injury: experience from a level-1 trauma centre. Chin J Traumatol. 2016;19(6):333–6.
11. Soto JR, Murry JS, Truitt MS, *et al*. Penetrating cardiac injuries at a Level II trauma center: a 15-year review. Am Surg. 2015;81(3):324–5.
12. Heus C, Mellema JJ, Giannakopoulos GF, *et al*. Outcome of penetrating chest injuries in an urban level I trauma center in the Netherlands. Eur J Trauma Emerg Surg. 2019;45(3):461–5.
13. Isaza-Restrepo A, Bolivar-Saenz DJ, Tarazona-Lara M, *et al*. Penetrating cardiac trauma: analysis of 240 cases from a hospital in Bogota. Colombia World J Emerg Surg. 2017;12:26.
14. Ball CG, Lee A, Kaminsky M, *et al*. Technical considerations in the management of penetrating cardiac injury. Can J Surg. 2022;65(5):E580–92.

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