https://doi.org/10.22502/jlmc.v9i2.451 **Original Research Article**

# In-hospital Outcomes in Patients Undergoing Percutaneous Coronary Intervention in Peri-urban Area Hospital Without Cardiac Surgery Backup

Manoj Shrestha[a,c], Prakash Aryal[b,c]

**ABSTRACT:**

**Introduction**: In centers without cardiac surgery backup, current guidelines recommend to conduct emergency percutaneous coronary intervention and discourage elective percutaneous coronary intervention. The objective of study was to evaluate the feasibility and safety of percutaneous coronary intervention in patients with stable coronary artery disease, acute coronary syndrome and ST segment elevation myocardial infarction in periurban area of Nepal without on-site cardiac surgical facilities. **Methods**: This retrospective single-centered study was done at College of Medical Sciences, Bharatpur, Nepal. The study included 600 patients who underwent percutaneous coronary intervention in the cardiology department cath lab from January 2014 to March 2020. Patients were evaluated for in-hospital outcomes, procedural success and post percutaneous coronary intervention complications within seven days of hospital stay. **Results:** Seventy percent (n=420) of percutaneous coronary intervention was emergency percutaneous coronary Intervention for acute coronary syndrome and 30% (n=180) of percutaneous coronary intervention was done as elective percutaneous coronary intervention for stable angina. Procedural success was 98% (n=176) for elective percutaneous coronary intervention and 93% (n=390) for emergency percutaneous coronary intervention. Sixteen percent (n=96) patients developed acute kidney injury, six percent (n=36) of patients developed pulmonary edema and cardiogenic shock respectively, 2% (n=12) patients developed post percutaneous coronary intervention myocardial infarction, 3% (n=18) patients developed bleeding complications, 0.5% (n=3) patients developed stroke and death rate was 3% (n=18). **Conclusion:** Percutaneous coronary intervention can be done with comparable and acceptable safety in peri-urban area hospital of Nepal without cardiac surgery backup with dedicated and experienced team.

**Keywords:** Cardiac Surgery, Percutaneous Coronary Intervention, Post Percutaneous Coronary Intervention Complications.

## INTRODUCTION:

Percutaneous Coronary Intervention (PCI), first introduced by Grüntzig in 1977 has been the main treatment for coronary artery disease.[1]

**Submitted:** 1 June, 2021
**Accepted:** 20 December, 2021
**Published:** 30 December, 2021

a- Lecturer, Department of Cardiology,
b- Lecturer, Department of Internal Medicine,
c- College of Medical Sciences, Bharatpur, Chitwan, Nepal

**Corresponding author:**
Manoj Shrestha
College of Medical Sciences, Bharatpur, Nepal
Contact: +977 9861901943
e-mail: drmanozshrestha@gmail.com
ORCID ID: 0000-0002-1862-7456

Cardiovascular diseases (CVDs) are the leading cause of death worldwide currently affecting low- and middle-income nations disproportionately.[2] In 2017, 26.9% of total deaths in Nepal was due to CVDs.[3] The most risky complications of PCI are myocardial infarction, stroke, death and emergency coronary

**How to cite this article:** Shrestha M, Aryal P. In-hospital Outcomes in Patients Undergoing Percutaneous Coronary Intervention in Peri-urban Area Hospital Without Cardiac Surgery Backup. Journal of Lumbini Medical College. 2022;9(2): pages. DOI: https://doi.org/10.22502/jlmc.v9i2.451

Epub: December 30, 2021.

*Licensed under* CC BY 4.0 *International License which permits use, distribution and reproduction in any medium, provided the original work is properly cited.*

artery bypass graft surgery (CABG).[4]

Over the last few years these risks have been significantly decreased with the development of new stents, drugs and most importantly the improved operator skills.[4] The requirement for doing emergency CABG has reduced significantly from 6% to 10%, during the period of balloon angioplasty, to 0.1% to 0.4% in recent time of stenting due to advancement in equipments, skills, adjunctive drugs, and operator experience.[5]

American Heart Association Percutaneous coronary intervention guidelines 2011, recommended emergency/urgent PCI be conducted by experienced operator in hospital with on-site cardiac surgery back up.[5,6] The guideline was updated in 2014 with the recommendation to perform emergency PCI only with the organized plan to shift the patients to nearest cardiac surgery facility if required and discouraged to perform elective PCI in centers without cardiac surgery backup.[5,6] However, there are several data suggesting no major differences in outcomes of emergency/elective PCI among hospitals with or without cardiac surgery backup.[7] Improved safety profile and low complication rate has encouraged to develop PCI facility in hospitals without cardiac surgery backup and treatment modality in community and periurban hospital for ST-elevation myocardial infarctions is being upgraded to primary PCI which has proven superiority over thrombolysis.[8] Early reperfusion in case of Acute Coronary Syndrome has major impact in survival with decrease in infarct size and complications. Starting the therapy to reperfuse the myocardium in Acute Coronary Syndrome within the certain window period is the mainstay to ensure better prognosis. This fact has contributed the tendency to develop the PCI facility in hospitals without cardiac surgery backup.[9] Hence, we evaluated in-hospital outcomes in patients undergoing PCI in hospital without cardiac surgery backup

## METHODS:

A descriptive observational study was conducted in the Cardiology Department of College of Medical Sciences (COMS), Bharatpur, Nepal after an approval was received from Institutional Review Committee (IRC protocol number: 287) of the same institute. The study included all the patients who underwent PCI in cardiology department of COMS after 2014. Rescue PCI after thrombolysis and balloon angioplasty patients were excluded. Retrospective data of the patients who underwent PCI in this institution from January 2014 to March 2020 were collected. A total of 600 patients had undergone PCI from January 2014 to March 2020. Altogether, 700 coronary vessels were stented with 740 stents.

Operational Definitions:

1. Procedural Success: It was defined as residual coronary artery stenosis after PCI less than 20% without in-hospital major clinical complications.
2. Post PCI complications: Post PCI myocardial infarction (rise in troponin I more than five times over baseline after 48 hours of PCI), pulmonary edema and cardiogenic shock, stroke, bleeding complications (puncture site hematoma, retro-peritoneal bleeding), acute kidney injury (increase in creatinine by more than 25% over baseline after 48 hours of procedure), ventricular tachycardia and death.

The collected data were analyzed using Statistical Package for Social Sciences release 20.0; (SPSS, Inc; Chicago, IL) system for Windows. Mean ± SD (Standard deviation) was used to express continuous variables and categorical variables were presented as frequencies and percentages. A p value <0.05 were considered statistically significant.

## RESULTS:

Seventy percent (n=420) of PCI was emergency PCI for acute coronary syndrome and 30% (n=180) of PCI was done as elective PCI for stable angina. Single vessel PCI was done in 400 patients, double vessels PCI in 150 patients,

triple vessels in 48 patients and PCI of the left main coronary artery was done in two patients (Table 1).

*Table 1. Extent of Coronary Artery Disease (CAD) and number of coronaries stented*

| Extent of coronary artery disease | Number of coronaries stented |
|---|---|
| 1 Vessel CAD | 400 |
| 2 Vessels CAD | 150 |
| 3 Vessels CAD | 48 |
| Left Main Coronary Artery Disease | 2 |

Out of total number of patients, 76% (456) were male and 24% (144) were female. Sixty two percent of patients were diabetic, 60% patients had family history of coronary artery disease, 53% were hypertensive, 43% had dyslipidemia and 20 % were smokers. The most common presenting symptom in acute coronary syndrome was chest pain (67%) and the most common symptom in stable angina was exertional chest pain. The most common acute coronary syndrome was anterior wall MI presenting in 25% of patients. Seventy percent got elective PCI and 30% of patients underwent primary PCI. (Table 2)

Procedural success was 98% (n=176) for elective PCI and 93% (n=390) for emergency PCI (Table 2). The most common complication after PCI was contrast induced nephropathy presenting as acute kidney injury (16%). Post PCI myocardial Infarction was diagnosed in 2% (n=12) of patients. The procedure was complicated by pulmonary edema and cardiogenic shock in 6% (n=36) of cases respectively. Stroke or transient ischemic attack was present in 0.5% (n=3) cases. Bleeding complications were present in 20%. Ventricular tachycardia was present in 5% (n=30) of patients. Three percent (18) of patients died after procedure of every type. Emergency PCI had death rate of 1.1% and elective PCI had death rate of 1.8% (Table 3).

*Table 2. Demographic characteristics, diagnosis and treatment strategy (N=600)*

| Variables | | Number (%) |
|---|---|---|
| **Risk factors** | Diabetes | 372 (62) |
| | Dyslipidemia | 258(43) |
| | Hypertension | 318 (53) |
| | Smoking | 120 (20) |
| | Family history of CAD | 360 (60) |
| **Presenting Symptoms** | Chest Pain at rest | 402 (67) |
| | Shortness of Breath | 240 (40) |
| | Abdominal Pain | 90 (15) |
| | Nausea/vomiting | 180 (30) |
| | Exertional Chest heaviness | 150 (25) |
| | Profuse Sweating | 312 (52) |
| | Syncope | 60 (10) |
| **Diagnosis** | Anterior Wall STEMI | 150 (25) |
| | Inferior Wall STEMI | 120 (20) |
| | Posterior Wall STEMI | 18 (3) |
| | Lateral Wall STEMI | 30 (5) |
| | NSTEMI | 72 (12) |
| | Unstable Angina | 30 (5) |
| | Stable Angina | 180 (30) |
| **Procedure Done** | Primary PCI | 180 (30) |
| | Elective PCI | 420 (70) |

*Table3. Post PCI Complications during hospital stay (N = 600)*

| Complications | Number (%) |
|---|---|
| Post-PCI Myocardial Infarction | 12 (2) |
| Pulmonary Edema | 36 (6) |
| Cardiogenic Shock and heart failure | 36 (6) |
| Stroke/Transient ischemic attack | 3 (0.5) |
| Puncture site hematoma | 120 (20) |
| Retro-peritoneal hematoma | 3 (0.5) |
| Acute Kidney Injury | 96 (16) |
| Ventricular Tachycardia | 30 (5) |
| Death in total PCI | 18 (3) |
| Death rate in emergency PCI | 7 (1.1) |
| Death rate in elective PCI | 11 (1.8) |

## DISCUSSION:

The objective of the study was to evaluate the outcome of PCI in hospitals without cardiac surgery backup. Emergency CABG after failed PCI was a common procedure in early 1980s with the rates up to 25%. The rates declined to 2-5% during late 1980s and to less than 1% in 1990s due to improvement in procedural success as a result in advancement in stent technology and newer drugs.[10]

Bleeding complications are common after PCI and include procedure related bleedings like puncture site bleeding, hematoma and retroperitoneal hemorrhage. Other bleeding complications like gastro-intestinal bleed and genito-urinary bleed are related to the use of antiplatelet and anti-coagulants. In a Japanese study in 2017, it was found that the frequency of access site hematoma was 26%, retro-peritoneal bleed was 3% and gastro-intestinal bleed was 9%.[11] In our study 20% of patients developed access site hematoma while diagnosed retroperitoneal bleeding was found in less than 1%.

Stroke related to PCI is an uncommon but serious complication. A study by Fuchs S et al. in 2002 showed the rate of peri-procedural stroke undergoing PCI from 1991 to 1999 was 0.38%.[12] Recent study in 2019 by Alkhouli M et al. mentioned the incidence of post-PCI ischemic stroke was 0.97% following PCI for ST-elevation myocardial infarction, 0.6% for non-ST-elevation myocardial infarction (STEMI) and 0.7% for unstable or stable angina.[13] In our study we found 0.5% of patients undergoing PCI had stroke during peri-PCI period.

Acute Kidney Injury (AKI) is a common complication after PCI. Tsai et al. mentioned the overall incidence of AKI in patients undergoing PCI and angiogram was 7.1% with 0.3% requiring dialysis.[14] In another study by Kanic et al. the incidence of AKI in patients undergoing coronary angiogram with or without PCI was 5.6% when radial access was used and 10.1% when femoral access was used.[15] The incidence of AKI in our study was 16%.

Both cardiogenic shock and heart failure are the main causes of death following primary PCI for STEMI. In a study, cardiogenic shock following primary PCI developed in 3.4% of patients with 90 days' mortality 54% and heart failure developed in 4.4% of patients with 90 days' mortality 10%.[16] In our study incidence of cardiogenic shock after PCI was 6% which is comparable to other studies.

König et al. reported the incidence of ventricular tachycardia (VT) after PCI was 2.6%.[17] Another study reported the incidence of VT after primary PCI was 4.3%. Ventricular tachycardia influences the short-term mortality but was found to have no long term impact on

mortality.[18]In our study the incidence of VT was 5% after PCI.

In a study by Carlsson et al. in UK in-hospital mortality after PCI of all types was 2.2% in hospitals without cardiac surgery backup and 1.4% in hospital with cardiac surgery backup.[1] In our study in-hospital mortality after PCI of all types was 3%. Kutcher et al. in 2006 study also mentioned the similar mortality, complication rates and success rates of PCI in between the hospitals with and without cardiac surgery backup.[19]

Emergency PCI for acute coronary syndrome including primary PCI for STEMI is the lifesaving procedure. Such facility should be developed at community level hospitals so that we do not lose the patient's life while transporting to one of the few centers of PCI available in Nepal.

Limitations:

The PCI procedures were done by different operators. So outcomes might be different as the procedure is operator dependent. Also the sample size was less and it was a single centered study.

## CONCLUSION:

The clinical outcome, complications and mortality rate of elective and emergency PCI in the peri-urban hospitals without cardiac surgery backup is acceptable and the result is comparable to other studies. Further studies with bigger sample size and multicenter involvement are required to assess the safety and feasibility of PCI in peri-urban area hospitals of Nepal.

**Conflict of interest:** None of the authors has conflict of interest.

**Source of Fund:** No funds available

## REFERENCES:

1. Carlsson J, James SN, Ståhle E, Höfer S, Lagerqvist B. Outcome of percutaneous coronary intervention in hospitals with and without on-site cardiac surgery standby. Heart. 2007;93(3):335-8. PMID: 16980517 DOI: https://doi.org/10.1136/hrt.2006.098061
2. Benjamin EJ, Blaha MJ, Chiuve SE, Cushman M, Das SR, Deo R, et al. Heart Disease and Stroke Statistics-2017 Update: A Report From the American Heart Association. Circulation. 2017;135(10):e146-e603. PMID: 28122885 DOI: https://doi.org/10.1161/cir.0000000000000485
3. Bhattarai S, Aryal A, Pyakurel M, Bajracharya S, Baral P, Citrin D, et al. Cardiovascular disease trends in Nepal – An analysis of global burden of disease data 2017. Int J Cardiol Heart Vas. 2020;30:100602. PMID: 32775605 DOI: https://doi.org/10.1016/j.ijcha.2020.100602
4. Singh M, Gersh BJ, Lennon RJ, Ting HH, Holmes DR Jr, Doyle BJ, et al. Outcomes of a system-wide protocol for elective and nonelective coronary angioplasty at sites without on-site surgery: the Mayo Clinic experience. Mayo Clin Proc. 2009;84(6):501-8. PMID: 19483166 DOI: https://doi.org/10.1016/s0025-6196(11)60581-8
5. Lee JM, Hwang D, Park J, Kim K-J, Ahn C, Koo B-K. Percutaneous Coronary Intervention at Centers With and Without On-Site Surgical Backup. Circulation. 2015;132(5):388-401. DOI: https://www.ahajournals.org/doi/full/10.1161/CIRCULATIONAHA.115.016137
6. Akasaka T, Hokimoto S, Sueta D, Tabata N, Oshima S, Nakao K, et al. Clinical outcomes of percutaneous coronary intervention for acute coronary syndrome between hospitals with and without onsite cardiac surgery backup. J Cardiol. 2017;69(1):103-9. PMID: 26928574 DOI: https://doi.org/10.1016/j.jjcc.2016.01.012

7. Singh M, Holmes DR Jr, Dehmer GJ, Lennon RJ, Wharton TP, Kutcher MA, et al. Percutaneous Coronary Intervention at Centers With and Without On-site Surgery: A Meta-analysis. JAMA. 2011;306(22):2487-94. PMID: 22166608 DOI: https://doi.org/10.1001/jama.2011.1790
8. Chui PW, Parzynski CS, Nallamothu BK, Masoudi FA, Krumholz HM, Curtis JP. Hospital Performance on Percutaneous Coronary Intervention Process and Outcomes Measures. J Am Heart Assoc. 2017;6(5):e004276. PMID: 28446493 DOI: https://doi.org/10.1161/jaha.116.004276
9. Koolen KH, Mol KA, Rahel BM, Eerens F, Aydin S, Troquay RP, et al. Off-site primary percutaneous coronary intervention in a new centre is safe: comparing clinical outcomes with a hospital with surgical backup. Neth Heart J. 2016;24(10):581-8. PMID: 27595816 DOI: https://doi.org/10.1007/s12471-016-0872-0
10. Angelini P. Guidelines for surgical standby for coronary angioplasty: should they be changed? J Am Coll Cardiol. 1999;33(5):1266-8. PMID: 10193726 DOI: https://doi.org/10.1016/s0735-1097(99)00002-9
11. Numasawa Y, Kohsaka S, Ueda I, Miyata H, Sawano M, Kawamura A, et al. Incidence and predictors of bleeding complications after percutaneous coronary intervention. J Cardiol. 2017;69(1):272-9. PMID: 27269413 DOI: https://doi.org/10.1016/j.jjcc.2016.05.003
12. Fuchs S, Stabile E, Kinnaird TD, Mintz GS, Gruberg L, Canos DA, et al. Stroke Complicating Percutaneous Coronary Interventions: Incidenc, predictors, and prognostic implicattions. Circulation. 2002;106(1):86-91. PMID: 12093775 DOI: https://doi.org/10.1161/01.cir.0000020678.16325.e0
13. Alkhouli M, Alqahtani F, Tarabishy A, Sandhu G, Rihal CS. Incidence, Predictors, and Outcomes of Acute Ischemic Stroke Following Percutaneous Coronary Intervention. JACC Cardiovasc Interv. 2019;12(15):1497-1506. PMID: 31395220 DOI: https://doi.org/10.1016/j.jcin.2019.04.015
14. Tsai TT, Patel UD, Chang TI, Kennedy KF, Masoudi FA, Matheny ME, et al. Contemporary incidence, predictors, and outcomes of acute kidney injury in patients undergoing percutaneous coronary interventions: insights from the NCDR Cath-PCI registry. JACC Cardiovasc Interv. 2014;7(1):1-9. PMID: 24456715 DOI: https://doi.org/10.1016/j.jcin.2013.06.016
15. Kanic V, Kompara G, Šuran D, Tapajner A, Naji FH, Sinkovic A. Acute kidney injury in patients with myocardial infarction undergoing percutaneous coronary intervention using radial versus femoral access. BMC Nephrol. 2019;20(1):28. PMID: 30700270 DOI: https://doi.org/10.1186/s12882-019-1210-8
16. French JK, Armstrong PW, Cohen E, Kleiman NS, O'Connor CM, Hellkamp AS, et al. Cardiogenic shock and heart failure post–percutaneous coronary intervention in ST-elevation myocardial infarction: Observations from “Assessment of Pexelizumab in Acute Myocardial Infarction”. Am Heart J. 2011;162(1):89-97. PMID: 21742094 DOI: https://doi.org/10.1016/j.ahj.2011.04.009
17. König S, Boudriot E, Arya A, Lurz J-A, Sandri M, Erbs S, et al. Incidence and characteristics of ventricular tachycardia in patients after percutaneous coronary revascularization of chronic total occlusions. PLoS One. 2019;14(11):e0225580. PMID: 31756220 DOI: https://doi.org/10.1371/journal.pone.0225580

18. Mehta RH, Harjai KJ, Grines L, Stone GW, Boura J, Cox D, et al. Sustained ventricular tachycardia or fibrillation in the cardiac catheterization laboratory among patients receiving primary percutaneous coronary intervention: Incidence, predictors, and outcomes. J Am Coll Cardiol. 2004;43(10):1765-72. PMID: 15145097 DOI: https://doi.org/10.1016/j.jacc.2003.09.072

19. Kutcher MA, Klein LW, Ou FS, Wharton TP Jr, Dehmer GJ, Singh M, et al. Percutaneous coronary interventions in facilities without cardiac surgery on site: a report from the National Cardiovascular Data Registry (NCDR). J Am Coll Cardiol. 2009;54(1):16-24. PMID: 19555835 DOI: https://doi.org/10.1016/j.jacc.2009.03.038