

Manual versus Mechanical Compression for Femoral Artery Hemostasis after Coronary Catheterization

Thesis

*Submitted for Fulfillment of Master Degree in
Medical-Surgical Nursing (Critical Care Nursing)*

By

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LIST OF ABBREVIATIONS

<i>Abb.</i>	<i>Meaning</i>
AHA	: American Heart association
ACT	: Activatd Clotting Time
AMI	: Acute Myocardial Infarction
AoV	: Aortic Valve
AP	: Angina pectoris
AV node	: Atrioventricular node
BMI	: Body mass index
CA	: Coronary Angiography
CABG	: Coronary Artery Bypass Graft
CAD	: Coronary Artery Disease
CBC	: Complete Blood Count
CC	: Cardiac Catheterization
CFA	: Common Femoral Artery
CRoC	: Compat Ready Clamp Compressor
CT scan	: Computed Tomography scan
ECG	: Electrocardiogram
ER	: Emergency room
FDA	: Food and Drug Administration
HDL	: High density lipoprotein
INR	: International Normalized Ratio
IV	: Intra-Venous

LAD	: Left Anterior Descending Artery
LCX	: Left Circumflex Artery
LDL	: Low Density Lipoprotein
LMCA	: Left Main Coronary Artery
LV	: Left ventricle
LVEF	: Left Ventricular Ejection Fraction
MEC	: Mechanical Compression
MC	: Manual Compression
MI	: Myocardial Infarction
MRI	: Magnetic Resonance Imaging
MV	: Mitral Valve
NSTEMI	: Non-ST Elevation Myocardial Infarction
PCI	: Percutaneous Coronary Intervention
PT	: Prothrombin Time
PTT	: Partial Thromboplastin Time
RCA	: Right coronary artery
SA node	: Sinoatrial node
SAP	: Stable angina pectoris
STEMI	: ST elevation myocardial infarction
UAP	: Unstable Angina Pectoris
US	: United states
VASCs	: Vascular Access Site Complications
VCDs	: Vascular Closure Devices
WHR	: Waist to Hip Ratio

Abstract

There are three methods are employed to achieve femoral artery hemostasis following sheath removal after cardiac catheterization, they are manual compression, mechanical compression and vascular closure devices. **Aim of the study:** (1) Compare the effect of using manual compression and mechanical compression technique in achieving hemostasis after femoral sheath removal through: Assessment of time to hemostasis, assessment of time to ambulate from bed and assessment of patient comfort level. (2) Compare the effect of using manual and mechanical compression technique on patient vascular complications through: Assessment of hematoma formation, assessment of ecchymosis formation, assessment of oozing and assessment of skin integrity. **Research design:** A comparative study design was used to conduct this study. **Setting:** cardiac catheterization unit at Beni-Suef General Hospital and Beni-Suef University Hospital. **Research subjects** A purposive sample of 121 patients admitted to the previous mentioned settings. **Tools for data collection:** Patients Interview questionnaire tool, femoral artery hemostasis measuring scales and patients' vascular complications monitoring scales. **Results:** 77.0% of patients were achieved hemostasis within 5 to < 10 minutes when using the Combat Ready Clamp compression compressor, while 38.5% of patients were achieved hemostasis from 5 to 10 minutes when using the manual compression method and patients in the manual group had higher score of pain at time of sheath removal, and at the other three assessment times (5, 10, 20 minutes) than patients in the compressor group. **Conclusion:** Combat Ready Clamp compression device is a safe, simple to use and effective alternative to the manual compression method for achieving hemostasis for the femoral artery after Coronary cathetrization. **Recommendations:** Provide an educational program for nursing stuff and health care providers about how to apply CRoC compression device and the most common post cardiac catheterization complications and how to manage them effectively.

Keywords : Manual, Mechanical, Compression, Hemostasis, Coronary Catheterization, Combat Ready Clamp

Introduction

Cardiovascular diseases are major causes of adult morbidity and mortality in Egypt **(El-Zanaty, 2015)** as ischemic heart disease is the leading cause of mortality and pre-mature deaths in Egypt **(Egyptprofile, 2017)**. Coronary artery disease (CAD) is a condition that is characterized by disruption of the integrity of the coronary arteries that supply blood to the heart muscle, usually due to a buildup of atherosclerotic plaque **(Barstow, Rice & McDivitt, 2017)**.

Coronary artery disease is the umbrella term for various syndromes of heart ischemia that are caused by atherosclerotic obstruction of the coronary arteries and leads to restriction of blood flow to the heart. The atherosclerotic damage ranges from gradual narrowing of the coronary arteries (due to bulging patches of plaque) to the sudden obstruction of a coronary artery by a blood clot that has been dislodged from the surface of a ruptured plaque **(Garg et al., 2017)**.

Cardiac Catheterization (CC) is considered the gold standard diagnostic test for CAD as it's performed to diagnose the extent and severity of coronary artery disease, valve disease, or disease of the aorta; evaluate heart muscle function; and to determine the need for further treatment, such as coronary artery bypass graft (CABG) surgery.

Cardiac catheterization can also be used for interventional purposes; if a blocked artery is detected, angioplasty and stenting can be performed during the procedure (**Hinkle and Cheever, 2014**).

Using arterial sheaths allow repeated access to the artery with catheters of different sizes and to manipulate guide wires as needed without significant blood loss as the sheath provided with valve. After finishing the procedure, the sheath is removed and a firm constant pressure is applied over the arteriotomy site to prevent bleeding and achieve hemostasis (**Chiesa, Rinaldi, Bertoglio, Marone, & Baccellieri, 2017**).

Vascular access site complications (VASCs) related to femoral artery remain an important source of increased morbidity, mortality, length of stay and cost. Incidence of VASCs post diagnostic coronary angiography includes: hematoma (1%–3%), retroperitoneal hematoma (0.2%–0.9%), arterial venous fistula (<0.5%), pseudoaneurysms (1%–6%), acute limb ischemia/acute arterial thrombosis (<0.1%) (**Gurzu & Jung, 2017**).

This incidence of complications increases with percutaneous coronary intervention (PCI), as it requires potent use of oral and intravenous antiplatelet and antithrombin medications which increase the effectiveness of PCI, but it is also accompanying with an increased risk

of VASCs. The reported incidence of VASCs during PCI is from 5.4% to 20%. Hematoma incidence (5% to 23%), retroperitoneal hemorrhage (0.15% to 0.44%), pseudoaneurysm (0.5% to 9%), arteriovenous fistula (0.2% to 2.1%), arterial occlusion (<0.8%), femoral neuropathy (0.21%) and infection (<0.1%) **(Farah & Abu-Fadel, 2016)**.

There are three methods are employed to achieve femoral artery hemostasis following sheath removal after cardiac catheterization, those methods are the manual compression, mechanical compression and vascular closure devices. Manual compression has been the gold standard for obtaining hemostasis at the vascular access site for years, but this standard has changed as new devices have come on the market **(Goswami, Smalling, Sinha, Gammon, & Ramaiah, 2016)**.

Manual compression for some practitioners is not an option because it requires strength and the ability to hold a good compression for 15 to 20 minutes and if hand and arm fatigue develops during the procedure, the amount of pressure applied to the femoral artery may vary causing vascular access site complications and it requires also long time for hemostasis and ambulation after achieving hemostasis **(Batiha, Abu-Shaikha, Alhalaiqa, Jarrad & Ramadan, 2016)**.

The second method is mechanical compression (MEC) which involves the application of constant pressure on the artery to obtain hemostasis for 10-20 minutes after sheath removal. MEC has many advantages such as allowing hands-free catheter removal so that nurses can monitor the patient and provide care as needed. Safe and noninvasive technique. Cost effective method as these devices are reusable and the technique itself is easy to learn. On the other hand, disadvantages include pain at arteriotomy site due to compression, prolonged mean time to achieve hemostasis (15 to 20 minutes) and prolonged mean time to safe ambulation (4 to 6 hours) **(Schulz-Schupke et al., 2014)**.

The used device in this study is a mechanical compressor called Combat ready clamp (CRoC) which was developed by the United States Army Medical Research (Combat Medical System, Fayetteville). CRoC was designed to exert mechanical pressure directly over the wound or indirectly over the groin area to occlude underlying blood vessels and stop hemorrhage, eliminating the need for manual pressure and provides hands free hemorrhage control and constant precise pressure as needed for hemostasis achievement **(Kotwal & Butler, 2017)**.

The interesting points about this device is that it is the first recommended device for seven-site junctional

hemorrhage control, and unlike inflatable, belt-like devices, the CRoC has a vice-like compression disk that provides advantage of creating bi-directional pressure exactly where it is needed most, preassembled configuration deploys in 10-20 seconds, rust and corrosion resistant, aluminum construction **(Guven, 2017)**.

The third method is vascular closure devices (VCDs) such as suturing and clip devices, and biodegradable devices which involve implanting a collagen seal into the arterial puncture site or a seaweed dressing device, but there are many disadvantages including that this is a difficult technique to learn as it has its own learning curve, it may take up to 20 cases to become proficient **(Vinayakumar et al., 2017)**.

Re-puncture is not recommended because a fibrous reaction of the groin triggered by the collagen and a new sheath could embolize the plug into the femoral artery or disrupt the plug in the tissue track, leading to bleeding at the previous arteriotomy site. Oozing from the incision or tissue track may occur also when the clip is used **(Prajapati, Rafi, Edalat, Kooby & Kim, 2014)**.