Results

The results of the study are presented in the following sequence of tables and graphs

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Part I: **Socio-demographic characteristics of study subjects**

Table1: Socio-demographic characteristics of nurses in the study sample (n=30)

	Frequency	**Percent**
Age(years):		
<30	21	70.0
30+	9	30.0
Range	22.0- 39.0	
Mean± SD	27.9± 3.9	
Job:		
Nurse	27	90.0
Specialist	3	10.0
Marital status:		
Single	13	43.3
Married	17	56.7
Nurses' Qualification:		
Nursing school diploma	23	76.7
Speciality diploma	4	13.3
Bachelor	3	10.0
Experience (years):		
<10	12	40.0
10+	18	60.0
Range	2.0-21.0	
Means± SD	10.0±4.3	
Attended training courses	20	66.7

Table 1 describes the socio-demographic data of the study nurses .their age ranged between 22and 39 years, with a mean ± SD 27.9 ± 3.9 years. More than half of the nurses (56.7 %) were married.

As regards nurses' qualification, more than two thirds of them (76.7%) had a diploma of secondary nursing school, and (13.3%) of them had speciality diploma, and only (10.0%) a bachelor degree in nursing , most of the nurses (60%) had ten or more years experience, with a mean ±SD 10.0 ±4.3 years. As attending training courses more than (66.7%) of them had attended such courses.

Part II: Nurses' knowledge about cardiovascular system & nursing care before and after the study intervention

Table 2: Nurses' knowledge about cardiovascular system & nursing care before and after the study intervention

Satisfactory Knowledge(60%+) of:	**Time**				**X2 Test**	**p-value**
	Pre (n=30)		**Post (n=30)**			
	No	**%**	**No**	**%**		
Cardiovascular anatomy	9	30.0	30	100.0	32.31	<0.001*
Cardiac arrest	28	93.3	29	96.7	Fisher	1.00
Atherosclerosis	22	73.3	28	93.3	4.32	0.04*
Central venous pressure (CVP)	24	80.0	30	100.0	Fisher	0.02*
Wound dressing	18	60.0	30	100.0	15.00	<0.001*
Intravenous therapy	24	80.0	29	96.7	Fisher	0.10
Laryngeal tube	15	50.0	30	100.0	20.00	<0.001*
Patient preparation for cardiac Surgery	18	60.0	29	96.7	11.88	0.001*
Cardiac surgery	7	23.3	30	100.0	37.30	<0.001*
Chest tube	14	46.7	28	93.3	15.56	<0.001*
Medications	25	83.3	30	100.0	Fisher	0.052
Ventilator	18	60.0	30	100.0	15.00	<0.001*
Total Knowledge:						
Satisfactory (60%+)	22	73.3	30	100		
Unsatisfactory <60%)	8	26.7	0	0.0	Fisher	0.005*

(*) Statistically significant at $p < 0.05$

Table 2: The nurses' knowledge about cardiovascular system & nursing care before and after the study intervention is illustrated in table 2.it indicates that nurses' knowledge in pre program was (73.3%) was satisfactory and they was (26.7%) was unsatisfactory. The lowest percentages of knowledge were related to cardiac surgery (23.3%), cardiovascular anatomy (30.0%), chest tube (46.7) and laryngeal tube (50.0) of them. And the highest percentages of knowledge were related to cardiac arrest (93.3%) of them. and it indicates that nurses' knowledge in post- program was (100%) was satisfactory. it is indicates that high percentages of adequate knowledge in most items. there are statistically significant improvements in almost tested areas.

And the table 2 also shows nurses' total knowledge about nursing care for patients undergo CABG surgery throughout program phases. It indicates that the nurses (73.3%) had total satisfactory knowledge at the pre-program phase. At the post-program phase, all nurses had satisfactory knowledge (100.0%), with a statistically significant improvement ($p<0.001$).

Part III: Nurses' practice related to patient care before and after the study intervention

Table 3: Nurses' practice regarding patient preparation before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Preparation						
***Collect appropriate equipment:**						
-Bed	30	100.0	30	100.0	0.00	1.00
-Ventilator	30	100.0	30	100.0	0.00	1.00
-Suction	19	63.3	29	96.7	10.42	0.001*
-Sphygmomanometer	17	56.7	28	93.3	10.76	0.001*
-Stethoscope	16	53.3	28	93.3	12.27	<0.001 *
-Observation chart	15	50.0	24	80.0	5.93	0.01*
-IV standard	19	63.3	27	90.0	5.96	0.01*
-Flush with heparin	25	83.3	29	96.7	Fisher	0.19
-Monitor	29	96.7	30	100.0	Fisher	1.00
-CVP manometer	26	86.7	30	100.0	Fisher	0.11
-Monitor and electrode introducer	29	96.7	30	100.0	Fisher	1.00

(*) Statistically significant at $p < 0.05$

Table 3 the nurses' practice regarding patient preparation before and after the study intervention is illustrated in table 3 in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to observation chart (50.0%) and auscultate heart with stethoscope is (53.3%) and sphygmomanometer (56.7%).in post program, it is indicates that high percentages of adequate practice in most skills. there are statistically significant improvements in some tested practices.

Table 4: Nurses' practice regarding patient assessment upon admission before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
On patient admission to ICU Assessment respiratory function:						
-Rate, depth and quality of respiration	28	93.3	30	100.0	Fisher	0.49
-Sign of respiratory distress, restlessness	19	63.3	25	83.3	3.07	0.08
-Rapid thready pulse	5	16.7	25	83.3	26.67	<0.001*
-Pallor or cyanosis	5	16.7	21	70.0	17.38	<0.001*
Cardiovascular Function:						
-Pulse rate, rhythm and quality/15 minutes	30	100.0	29	96.7	Fisher	1.00
-Blood pressure/15 min	19	63.3	27	90.0	5.96	0.01*
Skin						
-Color, Condition	18	60.0	29	96.7	11.88	0.001*
-Color of lip and nail beds	10	33.3	19	63.3	5.41	0.02*
Assess for fluid and electrolyte status						
-Monitoring ECG and cardiac arrhythmias	28	93.3	27	90.0	Fisher	1.00
-Assess neurologic status	17	56.7	25	83.3	5.08	0.02*
-Assess pain, needed for analgesic	15	50.0	20	66.7	1.71	0.19

(*) Statistically significant at $p < 0.05$

Table 4 the nurses' practice regarding patient assessment upon admission before and after the study intervention is illustrated in table 4 in pre program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to assessment of rapid thready pulse and assessment of pallor or cyanosis (16.7%), assess skin for colour of lip and nail beds (33.3%), assess pain, needed for analgesic (50.0%) and assess neurologic status (56.7%).the highest percentage of adequate practice in some skills are pulse rate, rhythm and quality 15 minutes (100%) and monitoring ECG and cardiac arrhythmias (93.3%). In post program, there are statistically significant improvements in all tested practices. This was particularly rapid thready pulse and pallor or cyanosis (<0.001), blood pressure/15 min (0.01), skin color and condition (0.001), and color of lip and nail beds, assess neurologic status (0.02).

Table 5: Nurses' practice regarding ongoing patient care about effective ventilation and monitoring cardiovascular status before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
On going care:						
A- Maintain effective ventilation:						
-Measure the tidal volume and arterial blood gases	27	90.0	28	93.3	Fisher	1.00
-Check end tracheal tube placement	20	66.7	28	93.3	6.67	0.01*
-Auscultate chest for breath sounds	17	56.7	25	83.3	5.08	0.02*
-Analysis of blood gases	12	40.0	23	76.7	8.30	0.004*
-Utilizes chest physiotherapy for patient with lung congestion	13	43.3	24	80.0	8.53	0.003*
-Suction tracheobronchial secretions	23	76.7	27	90.0	1.92	0.17
- Monitor cardiovascular status:						
-Take direct measurement (arterial line, transducer	8	26.7	15	50.0	3.45	0.06
-Check all peripheral pulses (pedial, tibial, radial, bronchial, popliteal, femoral and carotid)	6	20.0	15	50.0	5.93	0.01*
-Take central venous pressure readings hourly	27	90.0	26	92.0	Fisher	1.00
-Watch ECG monitor for cardiac arrhythmias	25	83.3	28	93.3	Fisher	0.42
-Auscultate the heart for evidence of cardiac tomponade	20	66.7	24	80.0	1.36	0.24
-check the skin (cool, moist skin)	11	36.7	24	80.0	11.59	0.001*

(*) Statistically significant at $p < 0.05$

Table 5 nurses' practice regarding ongoing patient care regarding effective ventilation and monitoring cardiovascular status before and after the study intervention is illustrated in table 5 in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to check all peripheral pulses(20%); take direct measurement arterial line, transducer(26.7%); check the skin (36.7%);analysis of blood gases(40%), utilizes chest physiotherapy for patient with lung congestion (43.3%), auscultate chest for breath sounds (56.7%) and check end tracheal tube placement , auscultate the heart for evidence of cardiac tomponade both of them are (66.7%). the highest percentage of adequate practice in some skills. This was particularly evident in relation to measure the tidal volume and arterial blood gas (90%) and take central venous pressure readings hourly (90%). in post program, there are statistically significant improvements in most tested practices. it is indicates that high percentages of adequate practice in most skills except these skill take direct measurement arterial line, transducer and check all peripheral pulses (pedial, tibial, radial bronchial, popliteal, femoral and carotid is (50.0%).

Table 6: Nurses' practice regarding ongoing patient care fluid balance, pain, and neurologic stability before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
On going care:						
C- Maintain fluid and electrolyte balance:						
-Determine all intravenous fluid taken	29	96.7	30	100.0	Fisher	1.00
-Record urine output every half hour to one hour	15	50.0	26	86.7	9.32	0.002*
D- Relieve patient pain:						
-Record nature ,type, location and duration of pain	19	63.3	28	93.3	7.95	0.005*
-Give medication as prescribed	17	56.7	25	83.3	5.08	0.02*
-Reassure patient	10	33.3	18	60.0	4.29	0.04*
E- Stability of neurologic status:						
-Check level of responsiveness	23	76.7	30	100.0	Fisher	0.01*
-Check for verbal response	18	60.0	29	96.7	11.88	0.001*
-Observe papillary size and reaction to light	8	26.7	24	80.0	17.14	<0.001*
-Give medication according to therapeutic directions	17	56.7	22	73.3	1.83	0.18

(*) Statistically significant at $p < 0.05$

Table 6 nurses' practice regarding ongoing patient care fluid balance, pain, and neurologic stability before and after the study intervention is illustrated in table 6 in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to observe papillary size and reaction to light (26.7%), reassure patient (33.3%), offer reassurance orientation to time and place (40%), record urine output every half hour to one hour (50%), give medication as prescribed and give medication according to therapeutic directions both of them are (56.7%), check for verbal response (60%) and record nature, type, location and duration of pain (63.3%). The highest percentage of adequate practice in some skills. This was particularly evident in relation to determine all intravenous fluid taken (96.7%). in post program, there are statistically significant improvements in most tested practices, it is indicates that high percentages of adequate practice in most skills except these skill reassure patient (60.0%), give medication according to therapeutic directions(73.3%)

Table7: Nurses' practice regarding care for patient on ventilator before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Care of patient on ventilator:						
-Check all connections of ventilator	26	86.7	27	90.0	Fisher	1.00
Observe endotracheal tube for :-						
-Cuff well sealed	14	46.7	19	63.3	1.68	0.19
-Tube unkinked	13	43.3	18	60.0	1.67	0.20
-Note tidal volume /hr	26	86.7	26	86.7	Fisher	1.00
-Check o2 lines hourly	16	53.3	24	80.0	4.80	0.03*
-Record humidifier volume and refill /8hr	9	30.0	21	70.0	9.60	0.002*
-Check temperature of inspired air	15	50.0	20	66.7	1.71	0.19
-Measure vital signs/15 min	28	93.3	30	100.0	Fisher	0.49
-Auscultate chest/15 min	23	76.7	28	93.3	Fisher	0.15
-Note any changes in breath sound	15	50.0	26	86.7	9.32	0.002*
-Aspirate tracheobronchial tree for sec	16	53.3	24	80.0	4.80	0.03*
-Maintain aseptic technique	13	43.3	17	56.7	1.07	0.30
-Introduce catheter gently during suction	23	76.7	24	80.0	0.10	0.75
-Manual hyperinflation of lungs with100% for for 2-3 minutes before and after o2 for 2-3 min.	23	76.7	27	90.0	1.92	0.17
-Record consistency, color, quantity of sputum during suction	21	70.0	28	93.3	5.45	0.02*
-Give mouth care /4 hour	8	26.7	20	66.7	9.64	0.002*
-Change respiratory therapy equipment	14	46.7	24	80.0	7.18	0.007*
-Measure arterial blood gases	21	70.0	23	76.7	0.34	0.56
-Monitor oxygen saturation , through oxyimeter	23	76.7	25	83.3	0.42	0.52
-Change patient position /2 hour	14	46.7	24	80.0	7.18	0.007*
-Help patient to do breathing exercises	16	53.3	22	73.3	2.58	0.11
-Help patient to ambulate	16	53.3	26	86.7	7.94	0.005*

(*) Statistically significant at $p < 0.05$

Table7 nurses' practice regarding care for patient on ventilator before and after the study intervention is illustrated in table 7 in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to give mouth care every 4 hr(26.7%), record humidifier volume and refill every 8 hrs (30%), tube un-kinked and maintain aseptic technique(43.3%),change position every 2 hrs and change respiratory therapy equipment (46.7%), check temperature of inspired air and note any changes in breath sound (50%), check o2 lines hourly, help patient to do breathing exercises, help patient to ambulate and aspirate tracheobronchial tree for 15 sec the percentages of these skills are (53.3%), record consistency, color, quantity of sputum during suction and measure arterial blood gases (70%). the highest percentage of adequate practice in some skills. This was particularly evident in relation to measuring vital signs (93.3%), note tidal volume and check all connections of ventilators (86.7%). in post program, there are statistically significant improvements in most tested practices; it is indicates that high percentages of adequate practice in most skills such as measuring vital signs(100%), record consistency, color, quantity of sputum during suction(93.3%). And check all connections of ventilators (90%).some procedures are inadequate percentages such as maintain aseptic technique (56.7%), tube un-kinked (60%), cuff well sealed (63.3%) and both of these procedures check temperature of inspired air and give mouth care /4 hr (66.7%).

Table 8: Nurses' practice related to patient care regarding assessment of neurologic signs and use of oxygen and catheter before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Assess neurologic signs/hr						
-Check level of responsiveness	26	86.7	30	100.0	Fisher	0.11
-Check for motor response	21	70.0	30	100.0	Fisher	1.00
-Observe papillary size	12	40.0	22	73.3	6.79	0.009*
-Notify he physician immediately if changes occur in level of responsiveness	27	90.0	29	96.7	Fisher	1.00
Use of oxygen therapy equipment						
-Wash hands	11	36.7	24	80.0	11.59	0.001*
-Explain the procedure to the patient	26	86.7	28	93.3	Fisher	0.67
-Assemble appropriate equipment	29	96.7	30	100.0	Fisher	1.00
-Position the bed to a comfortable working heights	25	83.3	28	93.3	Fisher	0.42
For the catheter:						
-Measure catheter length for insertion from nose to ear lobe	20	66.7	27	90.0	4.81	0.03*
-Lubricate tip with water soluble lubricant	25	83.3	29	96.7	Fisher	0.19
-Insert catheter and check length by looking into patient mouth	26	86.7	27	90.0	Fisher	1.00
-Secure catheter with tape	30	100.0	30	100.0	0.00	1.00

(*) Statistically significant at $p < 0.05$

Table 8 nurses' practice related to patient care regarding assessment of neurologic signs and use of oxygen and catheter before and after the study intervention is illustrated in table 8 in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to wash hands (36.7%), observe papillary size (40%), measure catheter length for insertion from nose to ear lobe (66.7%) and check for motor response (70.0%). the highest percentage of adequate practice in some skills. This was particularly evident in relation to secure catheter with tape (100%), assemble the appropriate equipment (96.7%). in post program, it is indicates that high percentages of adequate practice in most skills except observe papillary size and relation to light (73.3%).and there are statistically significant improvements in these procedures observe papillary size and reaction to light p- value (0.009),wash hands p- value (0.001)and measure catheter length for insertion from nose to ear lobe p- value (0.03).

Table 9: Nurses' practice related to patient care regarding suctioning before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Suctioning technique						
-Wash hands	7	23.3	21	70.0	13.13	0.001*
-Explain procedure to the patient	26	86.7	29	96.7	Fisher	0.35
-Positioning of the patient during procedure(semi fowler if conscious , lateral if unconscious	28	93.3	29	96.7	Fisher	1.00
-Hyper oxygenation prior to suctioning	15	50.0	25	83.3	7.50	0.006*
-Lubricate the catheter with sterile saline solution	26	86.7	29	96.7	Fisher	0.35
-Apply catheter gently without using suction	23	76.7	28	93.3	Fisher	0.15
-Gently rotate the catheter during applying suction	21	70.0	23	76.7	0.34	0.56
-Duration of suctioning(</> 15 sec)	18	60.0	24	80.0	2.86	0.09
-Flush the catheter between suction	17	56.7	24	80.0	3.77	0.052
-Apply post suctioning hyper oxygenation	11	36.7	25	83.3	13.61	<0.001*
-Post suctioning observation and recording	7	23.3	21	70.0	13.13	0.001*

(*) Statistically significant at $p < 0.05$

Table 9 nurses' practice related to patient care regarding suctioning before and after the study intervention is illustrated in table 9in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to wash hands and post suctioning observation and recording both of them are (23.3%), apply post suctioning hyper-oxygenation (36.7%), hyper-oxygenation prior to suctioning (50%), flush the catheter between suction(56.7%), duration of suctioning (</> 15 sec) (60.0%) and gently rotate the catheter during applying suction (70.0%). the highest percentage of adequate practice in some skills. This was particularly evident in relation to positioning of the patient during procedure (93.3%), explain procedure to the patient and lubricates the catheter with sterile saline solution (86.7%). in post program, it is indicates that high percentages of adequate practice in most skills except wash hands (70%) and post suctioning observation and recording (70%). and there are statistically significant improvements in these procedures wash hands p- value (0.001), hyper oxygenation prior to suctioning p-value (0.006) , apply post suctioning hyper oxygenation p-value (<0.001) and post suctioning observation and recording p-value (0.001).

Table 10: Nurses' practice related to patient care regarding maintenance of underwater seal before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Management of under water – seal drainage:-						
-Explain procedure to the patient	18	60.0	26	86.7	5.45	0.02*
-Note the character , consistency and amount of drainage in the drainage collection chamber	22	73.3	27	90.0	2.78	0.10
-Mark the drainage level in the drainage collection chamber	19	63.3	24	80.0	2.05	0.15
-Check the water level in the water seal chamber	19	63.3	26	86.7	4.36	0.04*
-Check for fluctuating in the water seal chamber as the patient breathes	24	80.0	26	86.7	0.48	0.49
-Observe the rate and quality of patient respirations	17	56.7	25	83.3	5.08	0.02*
-Secure tubing to the bedclothes by use of tape and safety pins	25	83.3	29	96.7	Fisher	0.19
-Keep artery clamps close proximity to patient	27	90.0	27	90.0	Fisher	1.00
-Positioning patient in a comfortable position	9	30.0	22	73.3	11.28	0.001*
-Encourage the patient to breath and do chest and arm exercises	13	43.3	23	76.7	6.94	0.008*
-Milking tubing towards the drainage bottles	15	50.0	22	73.3	3.45	0.06
-Keep the drainage bottle at floor level or below the patient level	26	86.7	29	96.7	Fisher	0.35
-Maintain patancy of the air vent in the system	23	76.7	23	76.7	0.00	1.00
-Dressing the chest tube /8 hour	21	70.0	30	100.0	Fisher	0.002*
-Encourage active or passive range of motion exercises for arm	14	46.7	26	86.7	10.80	0.001*
-Encourage early ambulation	13	43.3	20	66.7	3.30	0.07
-Give medication to pain if needed	20	66.7	27	90.0	4.81	0.03*
-Observe and report immediately signs of abnormal breathing cyanosis	18	60.0	24	80.0	2.86	0.09
-Chart accurate time, consistency, amount	24	80.0	29	96.7	Fisher	0.10

(*) Statistically significant at $p < 0.05$

Table 10 nurses' practice related to patient care regarding maintenance of underwater seal before and after the study intervention is illustrated in table 10in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to put patient in comfortable position (30%),encourage patient to breath and do chest and arm exercises and encourage early ambulation both of them are (43,3%), encourage active / passive range of motion exercises for arm (46.7%) , milk tubing towards drainage bottle(50%) ,observe rate and quality of patient respiration (56.7%) explain procedure to patient and observe and report immediately signs of abnormal breathing cyanosis both of them are (60%). the highest percentage of adequate practice in some skills. This was particularly evident in relation to keep artery clamps in close proximity to patient (90%) and keep drainage bottle at floor or below patient level (86.7%). in post program, there are statistically significant improvements in some tested practices. it is indicates that high percentages of adequate practice in most skills except encourage early ambulation (66.7%), milk tubing towards drainage bottle and put patient in comfortable position both of them are (73.3%).

Table 11: Nurses' practice related to patient care regarding removal of chest tube before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Chest tube:-						
-Wash hands	5	16.7	20	66.7	15.43	<0.001*
-Explain procedure to the patient	24	80.0	28	93.3	Fisher	0.25
-Check vital signs	19	63.3	27	90.0	5.96	0.01*
-Perform a respiratory assessment	13	43.3	20	66.7	3.30	0.07
-Administer analgesic 30 minutes before tube removal	16	53.3	25	83.3	6.24	0.01*
-Prepare equipment using strict aseptic technique	28	93.3	28	93.3	Fisher	1.00
-Place patient in semi -fowler's position	29	96.7	30	100.0	Fisher	1.00
-Place the linen – saver pad under the affected side	18	60.0	22	73.3	1.20	0.27
-Remove the old dressing	29	96.7	30	100.0	Fisher	1.00
-Put sterile gloves	10	33.3	20	66.7	6.67	0.01*
-Hold the chest tube in place with sterile forceps	28	93.3	30	100.0	Fisher	0.49
-Cuts the suture anchoring the tube	28	93.3	29	96.7	Fisher	1.00
-Maintain the chest tube is securely clamped	24	80.0	29	96.7	Fisher	0.10
-Instruct the patient to breath in to the maximum and hold breath	16	53.3	27	90.0	9.93	0.002*
-Hold an airtight dressing and cover the insertion site immediately after removing the tube	25	83.3	28	93.3	Fisher	0.42
-Tell the patient to exhale and relax	21	70.0	24	80.0	0.80	0.37
-Dispose the chest tube , solid gloves and equipment	21	70.0	28	93.3	5.45	0.02*
-Take vital signs , assess the depth and quality of the patient respiration	15	50.0	26	86.7	9.32	0.002*

(*) Statistically significant at $p < 0.05$

Table 11 nurses' practice related to patient care regarding removal of chest tube before and after the study intervention is illustrated in table 11in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to wash hands(16.7%), put on sterile gloves(33.3%),perform respiratory assessment(43.3%), take vital signs, assess depth and quality of patient respiration(50%), instruct patient to breath in the maximum and hold breath and administer analgesic 30 min before tube removal both of them are(53.3%) and place linen saver pad under affected side(60%),check vital signs(63.3%),tell patient to exhale and relax and dispose chest tube , solid gloves, equipment both of them are (70.0%). The highest percentage of adequate practice in some skills This was particularly evident in relation to place patient in semi- fowler position and removes old dressing (96.7%) and prepares equipment using strict aseptic technique and hold chest tube in place with sterile forceps and cut the suture anchoring the tube all of them are (93.3%). in post program, there are statistically significant improvements in some tested practices and it is indicates that high percentages of adequate practice in most skills except wash hands, perform respiratory assessment, put on sterile gloves (66.7%) and place linen saver pad under affected side (73.3%).

Table 12: Nurses' practice related to patient care regarding reading CVP before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Central venous pressure:-						
-Wash hands	7	23.3	24	80.0	19.29	<0.001*
-Explain procedure to the patient	26	86.7	30	100.0	Fisher	0.11
-Determine mid axillary line	24	80.0	24	80.0	0.00	1.00
-Position the patient in semi – recumbent position	27	90.0	30	100.0	Fisher	0.24
-Position the manometer parallel to right atrium	22	73.3	25	83.3	0.88	0.35
-Flush the line by intravenous fluid to run through into the patient	26	86.7	28	93.3	Fisher	0.67
-Turn off the three way , tap to the patient	26	86.7	30	100.0	Fisher	0.11
-Fill the manometer slowly	29	96.7	29	96.7	Fisher	1.00
-Turn off three – way tap to IV fluid.	29	96.7	30	100.0	Fisher	1.00
-Record the CVP measurement on the appropriate chart	19	63.3	24	80.0	2.05	0.15

(*) Statistically significant at $p < 0.05$

Table 12 Nurses' practice related to patient care regarding reading CVP before and after the study intervention is illustrated in table 12in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to wash hands (23.3%) , record CVP measurement on appropriate chart(63.3%) and position manometer parallel to right atrium (73.3%) . the highest percentage of adequate practice in some skills This was particularly evident in relation to turn off three way tap to IV fluid (96.7%),and put patient in semi-recumbent position (90%). in post program, it is indicates that high percentages of adequate practice in most skills and only one procedure is significant the wash hands the p- value is (<0.001).

Table 13: Nurses' practice related to patient care regarding removal of CVP before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Central Venous Pressure:-						
-Wash hands	12	40.0	25	83.3	11.92	0.001*
-Explain procedure to the patient	22	73.3	27	90.0	2.78	0.10
-Screen the bed	23	76.7	28	93.3	Fisher	0.15
-Prepare the equipment	29	96.7	30	100.0	Fisher	1.00
-Loosen the old dressing gently	21	70.0	28	93.3	5.45	0.02*
-Put on gloves	14	46.7	22	73.3	4.44	0.04*
-Remove the old dressing and discard it	25	83.3	26	86.7	Fisher	1.00
-Clean the insertion site	25	83.3	28	93.3	Fisher	0.42
-Discontinue the infusion	26	86.7	29	96.7	Fisher	0.35
-Cut and remove any skin suture securing the catheter	23	76.7	30	100.0	Fisher	0.01*
-Ask the patient to perform the valsalva manoeuvre	15	50.0	27	90.0	11.43	0.001*
-Cover the insertion site with sterile pad	23	76.7	25	83.3	0.42	0.52
-Hold the catheter and pull firmly and gently	24	80.0	24	80.0	0.00	1.00
-Press firmly down on the site with the pad	23	76.7	27	90.0	1.92	0.17
-Maintain pressure about five minutes after removal of the catheter	22	73.3	25	83.3	0.88	0.35
-Cover insertion site with sterile pad and tap it	20	66.7	28	93.3	6.67	0.01*
-Make the patient comfortable	11	36.7	16	53.3	1.68	0.19
-Discard the equipment used	13	43.3	19	63.3	2.41	0.12
-Record and chart removal time	21	70.0	28	93.3	5.45	0.02*

(*) Statistically significant at $p < 0.05$

Table 13 nurses' practice related to patient care regarding removal of CVP before and after the study intervention is illustrated in table 13in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to make patient comfortable (36.7%) wash hands (40%), discard used equipment (43.3%), put on gloves (46.7%), ask patient to perform Valsalva 's manoeuvre (50%), cover insertion site with sterile pad and tape it (66.7%), loosen old dressing gently and record and chart removal time both of them are (70.0%) and explain procedure to patient and maintain pressure about 5 min after removal of catheter both of them are (73.3%). The highest percentage of adequate practice in some skills this was particularly evident in relation to prepare equipment (96.7%) and discontinue infusion (86.7%). In post program, it is indicates that high percentages of adequate practice in most skills except make patient comfortable(53.3%), discard used equipment(63.3%)and put on gloves (73.3%) and there are statistically significant improvements in some tested practices such as wash hands and ask patient to perform Valsalva 's maneuver the p- value of these procedures are (0.001), loosen old dressing gently and record and chart removal time the p- value of these procedures are (0.02), put on gloves p- value (0.04), cut and remove any skin suture securing catheter and cover insertion site with sterile pad and tape it the p- value of these procedures are (0.01).

Table 14: Nurses' practice related to patient care regarding monitoring and maintaining IV infusion before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Monitoring and maintaining an intravenous infusion:-						
-Wash hand	10	33.3	26	86.7	17.78	<0.001*
-Prepare the needed equipment	30	100.0	30	100.0	0.00	1.00
-Explain procedure to the patient	20	66.7	30	100.0	12.00	0.001*
Follow principles of aseptic technique	10	33.3	24	80.0	13.30	<0.001*
-Ensure that the correct type and amount of fluid is infused with the specific time period	25	83.3	28	93.3	Fisher	0.42
-Identify early fluid infiltration phlebitis and signs of circulatory over load	22	73.3	27	90	2.78	0.10
-Report immediately for the physician	23	76.7	23	76.7	0.00	1.00
-Apply nursing care for these local complication	24	80.0	27	90.0	Fisher	0.47
-Check the functioning of intravenous sets(level, swelling around needle, patient reaction, flow rate)	28	93.3	28	93.3	Fisher	1.00
Discontinuing an intravenous infusion:						
-Maintain asepsis	19	63.3	27	90.0	5.96	0.01*
-Maintain adequate pressure after removal of the cannula	19	63.3	24	80.0	2.05	0.15
-Apply dressing over the site of vein puncture	20	66.4	27	90.0	4.81	0.03*
-Follow up for the site of vein puncture	18	60.0	21	70.0	0.66	0.42

(*) Statistically significant at $p < 0.05$

Table 14 nurses' practice related to patient care regarding monitoring and maintaining IV infusion before and after the study intervention is illustrated in table 14 in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to wash hands and follow principle of aseptic technique both of them are (33.3%), follow up for site of vein puncture (60.0%), maintain asepsis and maintain adequate pressure after removal of cannula both of them are (63.3%) ,apply dressing over site of vein puncture (66.4%) and explain procedure to the patient (66.7%). The highest percentage of adequate practice in some skills this was particularly evident in relation to prepare needed equipment (100%). In post program, it is indicates that high percentages of adequate practice in most skills except follow up for site of vein puncture (70%). and there are statistically significant improvements in some tested practices such as wash hands and follow principles of aseptic technique the p-value of these procedures are (<0.001), explain procedure to patient p-value (0.001), maintain asepsis p- value (0.01) and apply dressing over site of vein puncture p- value (0.03).

Table 15: Nurses' practice related to patient care regarding urinary catheter care before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
urinary catheter care:-						
-Wash hand	5	16.7	23	76.7	21.70	<0.001*
-Prepare the needed equipment	29	96.7	30	100.0	Fisher	1.00
-Explain the procedure to the patient	28	93.3	27	90.0	Fisher	1.00
-Arrange the bed clothes and exposed perineal area	24	80.0	30	100.0	Fisher	0.02*
-Wear sterile gloves	9	30.0	19	63.3	6.70	0.01*
-Drape the patient	9	30.0	18	60.0	5.45	0.02*
-Pour antiseptic on cotton balls	21	70.0	22	73.3	0.08	0.77
-Put some sterile ointment	23	76.7	27	90.0	1.92	0.17
-Assess the area around the urinary meatus for inflammation , swelling and discharge	24	80.0	30	100.0	Fisher	0.02*
-Clean a female in an anterior to posterior direction/a male around the catheter in circular direction	28	93.3	30	100.0	Fisher	0.49
-Using a new swab , clean a long the catheter for about 10 cm in circular motion	22	73.3	24	80.0	0.37	0.54
-Apply antiseptic ointment around the base	19	63.3	27	90.0	5.96	0.01*
-Inspect the patancy of the drainage system	21	70.0	26	86.7	2.45	0.12
-Keep the urinary catheter below the patient level	26	86.7	28	93.3	Fisher	0.67
-Taped the tube if the urinary catheter at thigh	12	40.0	23	76.7	8.30	0.004*
-Discard the used equipment	9	30.0	19	63.3	6.70	0.01*
-Wash hands	17	56.7	26	96.7	6.56	0.01*
-Record on the patient chart time of care and any abnormality	25	83.3	27	90.0	Fisher	0.71

(*) Statistically significant at $p < 0.05$

Table 15 nurses' practice related to patient care regarding urinary catheter care before and after the study intervention is illustrated in table 15 in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to wash hand (16.7%), wear sterile gloves, drape patient and discard equipment all of them are (30%), tape urinary catheter tube to thigh (40%), wash hands in the end of this procedure is also low percentage (56.7%), apply antiseptic ointment around base (63.3%) and pour antiseptic on cotton balls and inspect patency of drainage system both of them are (70.0%). The highest percentage of adequate practice in some skills This was particularly evident in relation to prepare needed equipment (96.7%) and explain procedure to the patient(93.3%). in post program, it is indicates that high percentages of adequate practice in most skills except drape patient (60%),wear sterile gloves and discard used equipment both of them are (63.3%) and pour antiseptic on cotton balls (73.3%). and there are statistically significant improvements in some tested practices such as wash hands before procedure p- value (<0.001), arrange bed clothes, assess area around urinary meatus for inflammation, swelling, discharge and expose perineal area p- value and drape patient all of them the p- value (0.02), wear sterile gloves, apply antiseptic ointment around base, discard used equipment and wash hands after the end of procedure all of them the p- value (0.01) and tape urinary catheter tube to thigh p- value (0.004).

Table 16: Nurses' practice related to patient care regarding removing retention catheter before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Retention catheter:-						
-Wash hand	10	33.3	26	86.7	17.78	<0.001*
-Prepare equipment	29	96.7	30	100.0	Fisher	1.00
-Explain the procedure to the patient	21	70.0	28	93.3	5.45	0.02*
-Wear gloves	17	56.7	22	73.3	1.83	0.18
-Deflate the balloon before removing it	28	93.3	30	100.0	Fisher	0.49
-Measure the urine in the drainage bag	23	76.7	29	96.7	Fisher	0.052
-Assess the frequency and amount of urine voided after removal	18	60.0	24	80.0	2.86	0.09
-Discard the used equipment	13	43.3	24	80.0	8.53	0.003*
-Wash hand	25	83.3	29	96.7	Fisher	1.00
-Record the time of removal on patient chart	26	86.7	27	90.0	Fisher	1.00

(*) Statistically significant at $p < 0.05$

Table 16 nurses' practice related to patient care regarding removing retention catheter before and after the study intervention is illustrated in table 16 in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to wash hand (33.3%), discard used equipment (43.3%), wear gloves (56.7%), assess frequency and amount of urine voided after removal (60%) and explain procedure to patient (70.0%). The highest percentage of adequate practice in some skills this was particularly evident in relation to prepare equipment (96.7%) and deflate balloon before removing it (93.3%). In post program, it is indicates that high percentages of adequate practice in most skills except wear gloves (73.3%). and there are statistically significant improvements in some tested practices such as wash hands p-value (<0.001), explain procedure to patient p- value (0.02) and discard used equipment p- value (0.003).

Table 17: Nurses' practice related to patient care regarding dry sterile dressing before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Dry sterile dressing:-						
-Wash hands	18	60.0	27	90.0	7.20	0.007*
-Prepare equipment needed	30	100.0	30	100.0	0.00	1.00
-Support the adjacent skin when removing adhesive tape	20	66.7	29	96.7	9.02	0.003*
-Pull tape toward the wound rather than a way from it	19	63.3	25	83.3	3.07	0.08
-Wear disposable gloves when removing moist outer dressing	14	46.7	26	86.7	10.80	0.001*
-Use separate sterile forceps to clean and dress the wound	23	76.7	30	100.0	Fisher	0.01*
-Use a suitable antiseptic solution	19	63.3	29	96.7	10.42	0.001*
-Use a separate swab for each cleaning stroke	19	63.3	27	90.0	5.96	0.01*
-Clean the wound from the least to the most contaminated area	22	73.3	26	86.7	1.67	0.20
-Clean a drain site after the incision	26	86.7	29	96.7	Fisher	0.35
-Dry the wound appropriately	20	66.7	28	93.3	6.67	0.01*
-Apply sufficient dressing to cover wound	29	96.7	28	93.3	Fisher	1.00
-Secure the dressing securely	28	93.3	28	93.3	Fisher	1.00
-Assess the wound appearance and drainage accurately	16	53.3	22	73.3	2.58	0.11
-Discard the used equipment	11	36.7	21	70.0	6.70	0.01*
-Wash hands	21	70.0	29	96.7	7.68	0.006*
-Record characteristics	25	83.3	30	100.0	Fisher	0.052

(*) Statistically significant at $p < 0.05$

Table 17 nurses' practice related to patient care regarding dry sterile dressing before and after the study intervention is illustrated in table 17 in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to discard used equipment (36.7%),wear disposable gloves when removing moist outer dressing (46.7%), assess wound appearance and drainage accurately (53.3%), wash hands before beginning procedure (60%), pull tape toward wound rather than a way from it and use a suitable antiseptic solution both of them are (63.3%), , support adjacent skin when removing adhesive tape , dry wound appropriately both of them are (66.7%) and wash hands after procedure also minor percentage (70.0%). The highest percentage of adequate practice in some skills This was particularly evident in relation to prepare equipment needed (100%), apply sufficient dressing to cover wound (96.7%) and secure dressing securely(93.3%). In post program, it is indicates that high percentages of adequate practice in most skills except discard used equipment (70%) and assess wound appearance and drainage accurately (73.3%). and there are statistically significant improvements in most tested practices such as wash hands before p-value (0.007),support adjacent skin when removing adhesive tape p-value (0.003), wear disposable gloves when removing moist outer dressing and use a suitable antiseptic solution the p- value of these procedures (0.001), use separate sterile forceps to clean and dress wound ,use a separate swab for each cleaning stroke , dry wound appropriately and discard equipment the p- value of these procedures (0.01) and wash hands after the procedure p- value (0.006).

Table 18: Nurses' practice related to patient care regarding basic cardiopulmonary resuscitation before and after the study intervention

	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Basic cardiopulmonary resuscitation						
-Note time of arrest.	14	46.7	27	90.0	13.02	0.001*
-Give patient pericardial thump if arrest monitored	21	70.0	29	96.7	7.68	0.006*
-Call for help	24	80.0	30	100.0	Fisher	0.02*
-Turn the patient on his back on firm surface	23	76.7	29	96.7	Fisher	0.052
-Establish and maintain a clear airway by extend the neck	25	83.3	29	96.7	Fisher	0.19
-Assess breathing; Maintain artificial ventilation by insert of an airway plus ambu bag and face mask	30	100.0	29	96.7	Fisher	1.00
-Assess circulation	30	100.0	30	100.0	0.00	1.00
When the cardiac arrest team arrives:						
-Attach patient to ECG monitor	26	86.7	30	100.0	Fisher	0.11
-Intubation	30	100.0	30	100.0	0.00	1.00
- Recommence ventilation and oxygenation once intubation is complete	30	100.0	30	100.0	0.00	1.00
-Establish a large vein	28	93.3	30	100.0	Fisher	0.49
Post resuscitation care:-						
-Assessing breathing , circulation, blood pressure, intake and output	24	80.0	30	100.0	Fisher	0.02*
-Assess patient level of consciousness	25	83.3	30	100.0	Fisher	0.052
-Positioning patient in appropriate position, check vital signs.	27	90.0	30	100.0	Fisher	0.24

(*) Statistically significant at $p < 0.05$

Table 18 nurses' practice related to patient care regarding basic cardio-pulmonary resuscitation before and after the study intervention is illustrated

In table 18 in pre-program it indicates that low percentages of adequate practice in some skills. This was particularly evident in relation to note time of arrest (46.7%) and give patient pericardial thump if arrest monitored (70%). It is indicates that high percentages of adequate practice in most skills. In post program, it is indicates that high percentages of adequate practice in all skills and there are statistically significant improvements in most tested practices such as note time of arrest p- value (0.001), give patient pericardial thump if arrest monitored p- value (0.006) and call for help and assess breathing, circulation, blood pressure, intake and output the p-value of these procedures are (0.02).

Part IV: Nurses' total practice of patient care before and after the study intervention

Table 19: Nurses' total practice related to patient care before and after the study intervention

performance of postoperative cardiac management (75%+)	Time				X2 Test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Preparation	15	50.0	28	93.3	13.87	<0.001*
Assessment	1	3.3	21	70.0	28.71	<0.001*
Ongoing care	0	0.0	27	90.0	49.09	<0.001*
Ventilator care	3	10.0	22	73.3	24.75	<0.001*
Neurologic signs	19	63.3	29	96.7	10.42	0.001*
Oxygen therapy	28	93.3	30	100.0	Fisher	0.49
Suctioning techniques	2	6.7	23	76.7	30.24	<0.001*
Underwater seal drainage	0	0.0	23	76.7	37.30	<0.001*
Removal of chest tube	8	26.7	27	90.0	24.75	<0.001*
Reading CVP	22	73.3	29	96.7	Fisher	0.03*
Removal of CVP	6	20.0	24	80.0	21.60	<0.001*
Monitoring IV infusion	12	40.0	26	86.7	14.07	<0.001*
Urinary catheter care	3	10.0	24	80.0	29.70	<0.001*
Removal of urinary catheter	9	30.0	27	90.0	22.50	<0.001*
Dry sterile dressing	12	40.0	29	96.7	22.26	<0.001*
Cardiopulmonary	17	56.7	29	96.7	13.42	<0.001*
resuscitation(CPR)	24	80.0	30	100.0	Fisher	0.02*
Total practice:						
Adequate (75%+)	5	16.7	29	96.7		
Inadequate (<75%)	25	83.3	1	3.3	39.10	<0.001*

(*) Statistically significant at $p < 0.05$

Table 19 illustrates nurses' total practice related to patient care before and after the study intervention. It indicated that they (16.7%) had adequate practice at the pre-program phase, whereas they (96.7%) had adequate practice at the post – program phase, and the difference was statistically significant ($p<0.001$).

And the table shows the nurses' total practice related to patient care throughout the program phases. It points to statistically significant improvements in all practice at the post program phase ($p<0.001$). The practice has reached (100%) in relation to oxygen therapy and cardiac arrest.

Part V: Relation between nurses' knowledge and practice before the study intervention and their demographic characteristics

Table 20: Relation between nurses' knowledge before the study intervention and their demographic characteristics

	Knowledge				X2 Test	p-value
	satisfactory		unsatisfactory			
	No	%	No	%		
Age (years):						
<30	15	71.4	6	28.5		
30+	7	77.7	2	22.2	Fisher	<0.001*
Job:						
Nurse	19	70.3	8	29.7		
Specialist	3	100.0	0	0.00	Fisher	<0.001*
Marital status						
Single	11	84.6	2	15.4		
Married	11	64.7	6	35.3	Fisher	0.41
Nursing qualification:						
Diploma	19	70.3	8	29.7		
Bachelor	3	100.0	0	0.00	Fisher	<0.001*
Experience (years):						
<10	7	58.3	5	41.7		
10+	15	83.3	3	16.7	Fisher	<0.001*
Attended training courses:						
No	9	40.9	1	12.5		
Yes	13	59.1	7	87.5	Fisher	0.21

(*) Statistically significant at $p < 0.05$

The relation between nurses' knowledge before the study intervention and their demographic characteristics is illustrated in table 20. It demonstrates A statistically significant increasing trend of knowledge score with increasing nurse's age ($p < 0.001$), job ($p<0.001$) and experience years ($p < 0.001$). Also, the bachelor degree nurses was statistically significantly higher than that of diploma nurses ($p < 0.001$).

Table 21: Relation between nurses' practice before the study intervention and their demographic characteristics

	Practice				X2 Test	p-value
	Adequate		Inadequate			
	No	%	No	%		
Age (years):						
<30	4	19.1	17	80.9		
30+	1	11.1	8	88.9	Fisher	1.00
Job:						
Nurse	5	18.5	22	81.5		
Specialist	0	0.0	3	100.0	Fisher	1.00
Marital status						
Single	3	23.0	10	77.0		
Married	2	11.7	15	88.3	Fisher	0.63
Nursing qualification:						
Diploma	5	18.5	22	81.5		
Bachelor	0	0.0	3	100.0	0.67	0.41
Experience (years):						
<10	2	16.6	10	83.4		
10+	3	16.6	15	83.4	Fisher	1.00
Attended training courses:						
No	3	30.0	7	70.0		
Yes	2	10.0	18	90.0	Fisher	0.30

(*) Statistically significant at $p < 0.05$

The relation between nurses' practice before the study intervention and their socio- demographic characteristics is presented in Table 21. It is evident that is no any significant relation between nurses' practice and demographic characteristics.

Part VI: Relation between nurses' knowledge and practice before the study intervention

Table 22: Relation between nurses' knowledge and practice before the study intervention.

Satisfactory practice (75+) of:	knowledge				X2 Test	p-value
	satisfactory		unsatisfactory			
	No	%	No	%		
Adequate(75%+)	5	22.7	0	0.0		
Inadequate (<75%)	17	77.3	8	100.0	Fisher	0.29

Table 22 illustrate the relation between nurses' knowledge and practice before the study intervention. And shows that no statistically significant between the nurses' knowledge and their practices (p =0.29).