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Original Article

Carotid And Vertebral Artery Injury, Case Series From Chiang Mai, Thailand

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Abstract **Carotid and vertebral artery injury is uncommon but may lead to stroke and death. We reported our experience over the last five years in our center. There were 14 cases: 11 cases with trauma and 3 cases with iatrogenic injury. Three cases had stroke and two cases died. The most common traumatic cases were penetrating injuries. Stab wound injuries had better prognosis than firearm injuries. Blunt trauma had the worst outcome due to severe organ injury. All iatrogenic cases were due to central line cannulation and all recovered uneventfully. Early recognition and proper treatment were crucial in these patients.**

Keywords: **carotid, vertebral, injury, stroke, trauma**

Introduction

Carotid and vertebral artery injuries can occur in both traumatic and iatrogenic injuries. Although they are uncommon but may lead to severe morbidity and mortality including disabling and fatal strokes[1,2,3]. Most studies of carotid and vertebral arteries were reported from western countries and presented in case series reviews[1,2,3]. Few studies were reported from developing countries which might have different etiology and pathology[4,5]. Therefore, we reviewed our series from Thailand as a representitive sample from developing countries.

Materials and Methods

Medical charts were reviewed for all carotid and vertebral injuries at the Maharaj Nakorn Chiang Mai Hospital between 2007 and 2011. Baseline data were collected, including age, gender, length of stay in hospital, mechanism of injury, initial vital sign, Glasgow Coma Score (GCS), imaging studies performed, location of injuries, management, and results of neurological deficits. In iatrogenic cases due to central line cannulation, further detailed data were collected on catheter type and cannulation techniques. This report presented data into two main categories namely;

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trauma and iatrogenic injuries. Data was summarized in mean and percentage. The Local Research Ethics Committee approved the study.

Results and Discussion

There were 14 patients who had either carotid or vertebral artery injuries (11 trauma and 3 iatrogenic injuries). There were 196 cases of neck injuries in the last five years. In 11 traumatic patient series (summary in Table 1), all cases were male and the mean age of patients was 26.9 years (range 14-49 years). Carotid artery and vertebral artery injuries were found in seven cases and five cases respectively. One case had combined carotid and vertebral artery injuries. There were eight penetrating injuries (five stab injury cases and three firearm injury cases) and three blunt injuries.

Stab injury cases

There were five cases with stab wounds at neck. A 41-year-old male patient (case 1) had injuries to both right carotid and vertebral arteries but came to the emergency unit without any neurological deficit. A carotid repair operation was performed with saphenous vein graft and ligation of the vertebral artery. The patient recovered uneventfully. A 17-year-old man with stab wounds (case 2) at the left vertebral artery and cervical venous plexus, consequently developed vertebrovertebral arteriovenous fistula. He came to the emergency unit in a coma and with profound shock. Firstly, a neck exploration was performed to stop bleeding, then a percutaneous embolisation for AVF was carrried out. He was discharged without any neurological deficit.

In another vertebral artery case (case 3) with a bracial plexus injury, the injuried artery was ligated and the patient recovered with brachial plexus radiculopathy. An 18-year-old man (case 4) had a carotid artery injury with a small asymptomatic aneurysm. The patient was treated with an antithrombotic agent. A 20-year-old man had a stab injury (case 5) in which the wound completely transected the right external and internal artery as well as a severe pharyngeal injury. He passed away due to massive infarction of the right hemisphere.

Firearm injury

There were one case of carotid artery injury and two cases of vertebral artery injury. The carotid case (case 6) had an injury of the internal carotid artery with right hemiparesis. A interposition graft with a saphenous vein was conducted and the patient recovered with the same level of neurological deficit as admission. The two remaining vertebral artery cases (case 7, 8) had arterial occlusion without any symptoms. Both of them were treated medically.

Blunt injury

A 14-year-old man (case 9) had a history of severe motorcycle accident. He suffered from hypotension and severe head injuries (GCS = 7). Since he had expanding hematoma on left side of the neck, he underwent immediate exploration after admission. The carotid artery was repaired with a saphenous vein graft. He also had pneumothorax and was treated with intercostal drainage. This patient expired on the day of operation due to severe multiple organ injury and brain infarction. Another two cases with blunt injury at neck (case 10,11) had carotid dissection with hemiparesis histories and they were treated with anticoagulant. The neurological deficit was similar as admission.

Treatment in traumatic carotid artery injuries can be done with either open surgical repair, endovascular techniques, antithrombotic agents and observation. Treatment options depend on mechanism, clinical severity, and imaging finding. Surgical repair is the definitive treatment for active bleeding cases or patients who had "hard sign"[6,7]. Endovascular treatments can be applied to two scenarios. Firstly, endovascular stenting should be considered in carotid dissection especially when inaccessible for surgical procedures and embolization techniques are applied for active extravasation of the vertebral artery. Antithrombotic therapy is recommended for blunt cerebrovascular injury grade I-IV and inaccessible areas[7]. Observation as a non operative treatment should be advocated in prolonged comatose patients (> 4 hours)[7]. In our case series, we found that the initial vital signs and GCS might not reflect an outcome or prognosis in penetrating injuries. In case 2, patient came to the emergency unit in a coma with

Table 1 Summary of baseline clinical data, diagnostic and treatment outcome in traumatic cases

Case No	Age	Mechanism	V/S	GCS	Artery	LOS (days)	Associated injury	CTA Finding	Management	Result
1	41	stab	stable	15	Rt.CCA, Rt.VA	6	-	-	operation	no neurodeficit
2	17	stab	unstable	3	Lt.VA	10	severe head injury, hand injury	VV fistula	operation, embolization	no neurodeficit
3	29	stab	stable	11	Lt.VA	6	brachial plexus injury	-	operation	radiculopathy
4	18	stab	stable	15	Rt.ICA	4	facial N. injury	false aneurysm	antithrombotic agents	no neurodeficit
5	20	stab	unstable	3	Rt.ICA,ECA	25	pharynx injury	extravasation	operation	brain Death
6	25	SGW	unstable	11	Lt.ICA	24	cranial N. 9,10 injury	-	operation	Rt.hemiparesis
7	18	GSW	unstable	11	Rt.VA	11	-	occlusion	-	no neurodeficit
8	47	GSW	stable	11	Lt.VA	6	Fx. cervical spine, facial bone	occlusion	-	no neurodeficit
9	14	blunt	unstable	7	Lt.CCA	1	severe head injury, pneumothorax	-	operation	Death
10	18	blunt	stable	14	Rt.ICA	37	liver injury	dissection	antithrombotic agents	Lt.hemiparesis
11	49	blunt	stable	6	Lt.ICA	31	Fx. Base of skull, Fx.zygoma	dissection	antithrombotic agents	Rt.hemiparesis

No = Number, SGW = short gun wound, GSW = gun shot wound, V/S = vital sign, Rt. = Right, Lt = Left, CCA = common carotid artery, VA = vertebral artery, ICA = internal carotid artery, ECA = external carotid artery, LOS = length of stay, N.=nerve, Fx = Fracture, VV = vertebrovertebral, CTA = computed tomographic arteriogram

profound shock, but recovered uneventfully. We believe that this coma might be due to profound shock. Therefore coma due to hypotension might have a chance of good recovery provided that proper management was conducted. We have not seen neurological abnormality in patients who have only vertebral artery injuries. Therefore, vertebral artery injuries alone seem to have good prognosis.

Iatrogenic injury

All three cases occurred from central line cannulation. A 72-year-old female (case 12) patient had leg ischemia and needed a central pressure measurement due to hypotension. The catheterization was done through the right internal jugular vein (without ultrasound technique) with catheter 7 Fr. The catheter was removed in the same session and no neurological deficit was found. A 69-year-old male (case 13) with cholangio-carcinoma had a central venous pressure measurement due to hypotension in the right internal jugular vein (without ultrasound technique) with catheter 7 Fr. After cannulation, patient had left hemiparesis for a short time. Then the catheter was removed nine hours after insertion. The last case, a 61-year-old female with known case end stage renal disease, needed double lumen cannulation for hemodialysis. This patient was inserted with a cuff dual lumen catheter 14.5 Fr. into the right internal jugular vein under an ultrasound guide. After the operation, this catheter was used for hemodialysis. A hemodialysis nurse observed that this patient had temporarily left hemiplegic during hemodialysis. The angiogram showed the catheter had passed through the right internal jugular vein to the right common carotid artery. The carotid artery was repaired with patch angioplasty and the vein was repaired with a lateral suture. After the operation, the patient recovered uneventfully.

Out of all iatrogenic carotid injury causes due to central line cannulation, two cases were carried out in a blind technique in intensive care (case 12, 13). We believe injuries such as these will come to our service more often because we change the approach of central catheterization from the cut down method to the internal jugular vein catheterization approach. This internal jugular approach aims to preserve peripheral vein and conducted less invasive mean. Perhaps guided ultrasound helps reduce this problem. However, medical literature shows that even by using ultrasound localization, the incidence of carotid artery injuries can still happen in 6% of cases due to the migration of the needle from the internal jugular vein to the common carotid artery[8]. This explains the mechanism of the case 14. In cases of absent ultrasound, we propose that pressure and waveform monitoring can give a clue to carotid arterial injuries. In cases of cannulation of catheter > 7 Fr., the current recommended advice is to remove the catheter under direct vision following neck exploration[8]. Gilbert and colleague reviewed 13 carotid artery cases that were cannulated accidentally with catheters > 7 Fr. 5 cases, catheters were removed and pressure packing without any surgical exploration and all cases had complications, namely massive stroke, AVF fistula, hemothorax, and hematoma at the neck[9]. Catheters of the remaining cases were removed in operative theater without any complications. Also, we recommend removing the catheter as soon as possible to avoid neurological events. As can be seen in our series, the catheter in one case (case 12) was removed immediately without any neurological deficit, whereas in another case the catheter was removed nine hours after insertion and patient developed brief weakness of the limb (transient ischemic attack).

Conclusions

Our findings showed that carotid and vertebral artery injuries were rare, and they showed poor prognosis. Our series found 14 cases over a 5 year period (11 trauma and 3 iatrogenic injuries). Of 14 cases, 3 cases had strokes and 2 cases died. The poor outcome came from the trauma series rather than the iatrogenic injuries series. Mostly mechanisms were penetrating, but blunt mechanisms were more severe than penetrating mechanisms in both morbidity and mortality. All iatrogenic injuries were due to central venous cannulation.

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