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CASE REPORT
Reconstructive

Late Arterial Thrombosis after Microvascular Head and Neck Reconstruction due to Combined Factors of Pedicle Artery Loop and Submandibular Gland Swelling

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Summary: Late arterial thrombosis of a free flap is rare and usually unsalvageable because it is hard to detect. We herein report 2 cases of arterial thrombosis of a free flap after microvascular head and neck reconstruction due to the combined factors of pedicle artery loop and compression by a swollen submandibular gland, the occurrence of thrombosis in both of which was > 72 hours after the operation. In case 1, the arterial thrombosis was undetectable, and it was too late for a successful take-back operation, so the flap was lost. However, we applied the lessons learned from case 1 and were able to detect the late arterial thrombosis of case 2 at an early stage; we subsequently salvaged the flap successfully. During the take-back operation in both cases, it was found that the submandibular gland became swollen and compressed the pedicle artery, which then became occluded due to a steep loop formation. Postoperative swelling of the submandibular gland can sometimes compress the vascular pedicle, and complete occlusion of the pedicle artery may occur when it is looped. Meticulous care concerning the geometry of the vascular pedicle is required to avoid such complications. *(Plast Reconstr Surg Glob Open 2017;5:e1446; doi: 10.1097/GOX.0000000000001446; Published online 24 August 2017.)*

The definition of "late" thrombosis after free flap reconstruction is ambiguous, and the threshold timing reportedly ranges from 48 hours to several days after operation.[1–4] However, arterial thrombosis tends to occur less frequently and earlier than venous thrombosis, and "late" arterial thrombosis after a free flap transfer is supposed to be quite rare.[5,6] Arterial thrombosis is difficult to detect at an early stage, and the salvage rate after arterial thrombosis has been reported to be lower than that after venous thrombosis.[7] We herein report 2 cases of arterial thrombosis that occurred > 72 hours after microvascular head and neck reconstruction due to the combined factors of pedicle artery loop and submandibular gland swelling.

CASE 1

A 69-year-old man presented with oropharyngeal cancer (Fig. 1). He underwent lateral oropharyngectomy and right modified neck dissection. The defect was reconstructed with a free anterolateral thigh flap. The vascular pedicle of the flap was passed through the submandibular route to the neck, and the right superior thyroid artery (STA) and right internal jugular vein were used for recipient vessels. The pedicle artery formed a small steep loop. The submandibular gland was sutured and fixed to a space under the mandible bone and covered by muscles of the flap to avoid compressing the area of anastomosis.

The flap perfusion was considered fine until the third postoperative day. On the fourth postoperative day, the flap became completely ischemic, and reoperation was performed. The submandibular gland covered by muscles had become swollen and compressed the pedicle artery loop. Debridement of the failed flap and re-reconstruction by an anterolateral thigh flap from the other thigh was performed. The vascular pedicle was passed above the space of the mandibular bone defect after marginal resection to avoid compression, and the right transverse cervical artery and right internal jugular vein were used for recipient vessels. The postoperative course after the take-back operation was uneventful.

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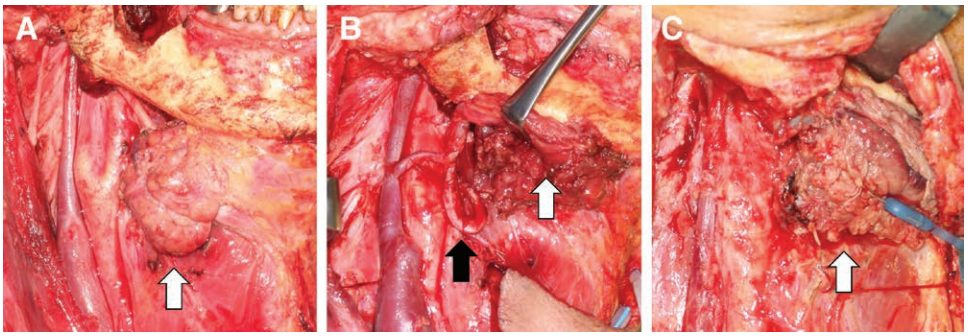

Fig. 1. The intraoperative appearance of the submandibular area of case 1. A, Before reconstruction. The submandibular gland is indicated with a white arrow. B, After anastomosis of the pedicle vessels. The pedicle artery was anastomosed to superior thyroid artery and formed a loop (indicated with a black arrow). The submandibular gland was sutured and fixed to a space under the mandible bone and covered by muscles of the flap (pointed by white arrow) to avoid compressing the area of anastomosis. C, Before flap debridement at reoperation. The submandibular gland covered by muscle swelled and protruded outside the mandible bone beyond the effects of suturing and fixing (pointed by white arrow). The pedicle vessels had already been cut away.

CASE 2

A 77-year-old woman presented with a right maxillary osteosarcoma (Fig. 2). She underwent right total maxillectomy and modified neck dissection. The defect was reconstructed with a free deep inferior epigastric artery perforator flap. The vascular pedicle of the flap was passed through the submandibular route to the neck, and the right lingual artery and right external jugular vein were used for recipient vessels. The pedicle artery formed a loop, and the submandibular gland was sutured and fixed toward the upper side to avoid compressing the area of anastomosis.

The flap perfusion was considered fine through the morning examination on the third postoperative day. At evening rounds on that day, bleeding by a pinprick test was found to be weak. During the take-back operation, the submandibular gland had become swollen, and the pedicle artery had then become occluded due to compression by the gland. The pedicle vein remained patent. The pedicle artery was reanastomosed to the right STA. The submandibular gland was then prophylactically excised to prevent compression. The postoperative course after the take-back operation was uneventful.

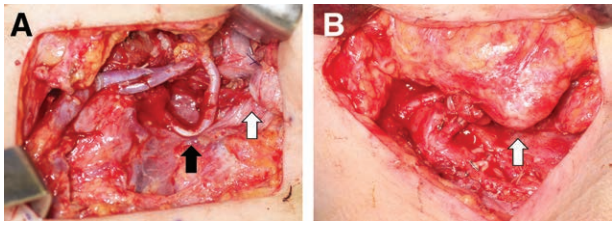

Fig. 2. The intraoperative appearance of the submandibular area of case 2. A, After anastomosis of the pedicle vessels. The pedicle artery was anastomosed to the lingual artery and formed a loop (indicated with a black arrow). The submandibular gland was sutured and fixed toward the upper side (indicated with a white arrow) to avoid compressing the area of anastomosis. B, After reanastomosis of the pedicle artery at reoperation. The occluded pedicle artery was cut and anastomosed to the superior thyroid artery. The submandibular gland swelled and protruded toward the pedicle vessels (indicated with a white arrow). The submandibular gland was then removed to prevent compression of the anastomosis area.

DISCUSSION

We experienced 2 cases that developed late arterial thrombosis due to the combined factors of pedicle artery loop and compression by a swollen submandibular gland, despite receiving intraoperative careful management to avoid compression by the submandibular gland. We applied the lessons learned from case 1 and were able to detect the late arterial thrombosis of case 2 at an early stage and salvage the flap successfully.

In terms of submandibular gland swelling, 2 possible causes were suspected. First, salivary duct obstruction may have occurred by surgical injury. In the first case, the floor of the oral cavity was widely resected, which may have resulted in the salivary duct being injured or resected. In the second case, although the tissue defect extended from the maxillary region to beside the root of the tongue, the salivary duct may have been injured when making the vascular pedicle route to the neck area. Second, fluid shifting from the intravascular to the interstitial space usually occurs within several days after surgery and soft tissues become swollen.[8] In the present cases, the fluid balances were consistently positive after the operation and only started to turn negative from the third postoperative day. Tissue edema was, therefore, considered to be at its peak on the third postoperative day. The findings during reoperation revealed that the submandibular gland was obviously protruding toward the vascular pedicle. We suspected that the swollen submandibular gland had compressed the vascular pedicle, which resulted in complete arterial occlusion in both cases.

In terms of the pedicle arrangement, loop formation of the pedicle artery is common when using the STA as a recipient vessel because the artery naturally lies in a caudal arrangement.[9] It rarely becomes problematic, as arteries are less susceptible to kinking than veins; however, the atherosclerotic artery may be weak to kinking when looped. In addition, there is usually not enough space in the submandibular region to avoid compression by a swollen submandibular gland.

There are 2 possible ways to prevent arterial occlusion in such cases. The first is avoiding loop formation by ad-

justing the length of the pedicle artery. If the geometry of the pedicle artery is found to be undesirable after revascularization, reanastomosis of the artery should be considered. The second is prophylactic excision of the submandibular gland. Submandibular gland excision is commonly considered to be a simple operation; however, there is a significant risk of marginal mandibular palsy. The indications of excision should be evaluated carefully with consideration of the geometry of the pedicle artery and estimation of the postoperative swelling of the gland.

CONCLUSIONS

We experienced 2 similar cases of late arterial thrombosis resulting from the combined factors of a pedicle artery loop and compression by a swollen submandibular gland. Meticulous care concerning the geometry of the vascular pedicle is required to avoid such complications.

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