

nicates with the glans and, in some cases, with the corpus spongiosum directly via its own circumflex vein. These para-arterial veins become greatly engorged if the cavernous sinusoids are squeezed, unless the cadaver is dry, implying that a substantial amount of sinusoidal blood can shunt via the emissary veins. Thus both the cavernosal and para-arterial veins play an important role in the circulation of the cavernosal sinusoids. Both of them are housed in their own perivascular sheaths which differ from that of the deep dorsal vein and individually drain into Santorini plexus, therefore they should not be regarded as branch veins.

The retrocoronal plexus is responsible for draining the glandular sinusoids. The number of veinlets at the level of the coronal sulcus varied greatly and were sometimes numerous (see Fig. 5). They could be seen to merge variously with the deep dorsal vein, cavernosal vein, and para-arterial veins (the last also had communicating veins). Thus they serve as a communicating channel between the sinusoids of the glans and the corpora cavernosa. Hemodynamically, this results in a pressure-dependent phenomenon in the pendulous portion of the penis. The amount of blood within the sinusoidal tissues and the complexity of the venous anatomy (intermingling with arteries and numerous small nerves) may discourage surgeons from attempting venous stripping surgery. In our experience, asking an assistant to compress the cavernosal and glandular sinusoids to control bleeding will facilitate dissection and encourage the complete stripping which is possible if the cavernosal as well as the para-arterial veins are not overlooked. During cadaveric dissection, the veinlets are susceptible to instrumental injury because the distensibility of their walls are compromised by formalin immersion.

The dorsal artery gradually spreads out distally. At the level of the retrocoronal sulcus, the left and right ones are located at the 3 and 9 o'clock positions, respectively; however it may send a branch coursing centrally (12 o'clock position, Fig. 5A). During dissection, a microscope is very helpful in differentiating arteries from veins without the necessity of a special stain.

ACKNOWLEDGEMENTS

We would like to thank Prof. S.-M. Wang, chairman of the Department of Anatomy, National Taiwan University, for the availability of cadavers for completion of this work.

REFERENCES

1. Fitzpatrick, T. The corpus cavernosum intercommunicating venous drainage system. *J. Urol.* 1975; **113**: 494-496.
2. Delcour, C., Wespes, E., Schulman, C. C., Struyven, J. Investigation of the venous system in impotence of vascular origin. *Urol. Radiol.* 1984; **6**:190-193.
3. Porst, H., Altwein, J. E., Bach, D., Thon, W. Dynamic cavernosography: venous outflow studies of cavernous bodies. *J. Urol.* 1985; **134**: 276-279.
4. Bookstein, J. J., Lurie, A. L. Selective penile venography: anatomical and hemodynamic observations. *J. Urol.* 1988; **140**: 55-60.
5. Fuchs, A. M., Mehringer, C. M., Rajfer, J. Anatomy of penile venous drainage in potent and impotent men during cavernosography. *J. Urol.* 1989; **141**: 1353-1356.
6. Moscovici, J., Galinier, P., Hammoudi, S., Lefebvre, D., Juricic, M., Vaysse, P. Contribution to the study of the venous vasculature of the penis. *Surg. Radiol. Anat.* 1999; **21**: 193-199.
7. Wooten, J. S. Ligation of the dorsal vein of the penis as a cure for atonic impotence. *Tx. Med. J.* 1902; **18**: 325-328.
8. Lue, T. F. Penile venous surgery. *Urol. Clin. N. Am.* 1989; **16**: 607-612.
9. Knoll, L. D., Furlow, W. L., Benson, R. C. Penile venous ligation surgery for the management of cavernosal venous leakage. *Urol. Int.* 1992; **49**: 33-39.
10. Hsu, G. L., Brock, G. B., Martinez-Pineiro, L., Nunes, L., von Heyden, B., Lue, T. F. The three-dimensional structure of the tunica albuginea: anatomical and ultrastructural levels. *Int. J. Impot. Res.* 1992; **4**: 117-123.
11. Banya, Y., Ushiki, T., Takagane, H., Aoki, H., Kubo, T., Ohhori, T., Ide, C. Two circulatory routes within the human corpus cavernosum penis: a scanning electron mi-