

cerebral ischemia without the following reperfusion and low body temperature. We need to be aware of these postmortem changes as the demand for immediate post-mortem imaging examination, including MRI, has been increasing.

**Acknowledgments.** This work was supported by a grant the Japanese Ministry of Health, Labour, and Welfare for research into “Investigation of postmortem images to assist autopsy in the detection of death causes related to medical examination and treatment (2008–2009).” The authors thank Ms. Yumiko Moriyama for assisting in manuscript preparation.

## References

1. Brogdon BG. Research and applications of the new modalities. In: Brogdon BG, editor. *Forensic radiology*. 1st edn. Boca Raton: CRC Press; 1998. p. 333–8.
2. Swift B, Ruttly GN. Recent advances in postmortem forensic radiology: computed tomography and magnetic resonance imaging applications. In: Tsokos M, editor. *Forensic pathology reviews*. 1st edn. Totowa: Humana; 2006. p. 355–404.
3. Uchigasaki S. Postmortem ultrasound imaging in forensic pathology. In: Tsokos M, editor. *Forensic pathology reviews*. 1st edn. Totowa: Humana; 2006. p. 405–12.
4. Dirnhofer R, Jackowski C, Vock P, Potter K, Thali MJ. Virtopsy: minimally invasive, imaging-guided virtual autopsy. *Radiographics* 2006;26:1305–33.
5. Hayakawa M, Yamamoto S, Motani H, Yajima D, Sato Y, Iwase H. Does imaging technology overcome problems of conventional postmortem examination? A trial of computed tomography imaging for postmortem examination. *Int J Legal Med* 2006;120:24–6.
6. Oyake Y, Aoki T, Shiotani S, Kohno M, Ohashi N, Akutsu H, et al. Postmortem computed tomography for detecting causes of sudden death in infants and children: retrospective review of cases. *Radiat Med* 2006;24:493–502.
7. Chew FS, Relyea-Chew A, Ochoa ER Jr. Postmortem computed tomography of cadavers embalmed for use in teaching gross anatomy. *J Comput Assist Tomogr* 2006;30:949–54.
8. Ljung P, Winskog C, Persson A, Lundstrom C, Ynnerman A. Full body virtual autopsies using a state-of-the-art volume rendering pipeline. *IEEE Trans Vis Comput Graph* 2006;12: 869–76.
9. Poulsen K, Simonsen J. Computed tomography as routine in connection with medico-legal autopsies. *Forensic Sci Int* 2007;171:190–7.
10. Levy AD, Harcke HT, Getz GM, Mallak CT, Caruso JL, Pearse L, et al. Virtual autopsy: two- and three-dimensional multidetector CT findings in drowning with a autopsy comparison. *Radiology* 2007;243:862–8.
11. O'Donnell C, Rotman A, Collett S, Woodford N. Current status of routine post-mortem CT in Melbourne, Australia. *Forensic Sci Med Pathol* 2008;3:226–32.
12. Shiotani S, Shiigai M, Ueno Y, Sakamoto N, Atake S, Kohno M, et al. Postmortem computed tomography findings as evidence of traffic accident-related fatal injury. *Radiat Med* 2008;26:253–60.
13. Weustink AC, Hunink MGM, van Dijke CF, Renken NS, Krestin GP, Oosterhuis JW. Minimally invasive autopsy: an alternative to conventional autopsy? *Radiology* 2009;250: 897–904.
14. Sakamoto N, Ohashi N, Hamabe Y, Kohno M, Shiotani S, Hayakawa H, et al. Answers to questionnaire regarding current status and future subjects of postmortem imaging in Japanese emergency center hospitals. *Kyukyu Igaku (Japanese Journal of Acute Medicine)* 2009;33:985–9 (in Japanese with English abstract).
15. Shiotani S, Kohno M, Ohashi N, Yamazaki K, Nakayama H, Watanabe K, et al. Non-traumatic postmortem computed tomographic (PMCT) findings of the lung. *Forensic Sci Int* 2004;139:39–48.
16. Shiotani S, Watanabe K, Kohno M, Ohashi N, Yamazaki K, Nakayama H. Postmortem computed tomographic (PMCT) findings of pericardial effusion due to acute aortic dissection. *Radiat Med* 2004;22:405–7.
17. Shiotani S, Kohno M, Ohashi N, Yamazaki K, Itai Y. Post-mortem intravascular high density fluid level (hypostasis): CT findings. *J Comput Assist Tomogr* 2002;26:892–3.
18. Shiotani S, Kohno M, Ohashi N, Yamazaki K, Nakayama H, Ito Y, et al. Hyperattenuating aortic wall on postmortem computed tomography (PMCT). *Radiat Med* 2002;20:201–6.
19. Shiotani S, Kohno M, Ohashi N, Yamazaki K, Nakayama H, Watanabe K, et al. Dilatation of the heart on postmortem computed tomography (PMCT): comparison with live CT. *Radiat Med* 2003;21:29–35.
20. Shiotani S, Kohno M, Ohashi N, Yamazaki K, Nakayama H, Watanabe K, et al. Postmortem computed tomographic (PMCT) demonstration of the relation between gastrointestinal (GI) distension and hepatic portal venous gas (HPVG). *Radiat Med* 2004;22:25–9.
21. Shiotani S, Kohno M, Ohashi N, Atake S, Yamazaki K, Nakayama H. Cardiovascular gas on non-traumatic postmortem computed tomography (PMCT): the influence of cardiopulmonary resuscitation. *Radiat Med* 2005;23:225–9.
22. Tofts PS, Jackson JS, Tozer DJ, Cercignani M, Keir G, MacManus DG, et al. Imaging cadavers: cold FLAIR and non-invasive brain thermometry using CSF diffusion. *Magn Reson Med* 2008;59:190–5.
23. Yen K, Lovblad KO, Scheurer E, Ozdoba C, Thali M, Aghayev E, et al. Post-mortem forensic neuroimaging: correlation of MSCT and MRI findings with autopsy results. *Forensic Sci Int* 2007;173:21–35.
24. Shepherd R. Unexpected and sudden death from natural causes. In: Shepherd R, editor. *Simpson's forensic medicine*. 12th edn. London: Arnold; 2003. p. 120–7.
25. Sarwar M, McCormick WF. Decrease in ventricular and sulcal size after death. *Radiology* 1978;127:409–11.
26. Dähnert W. Infarction of brain. In: Dähnert W, editor. *Radiology review manual*. 6th edn. Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins; 2006. p. 299–300.
27. Osborn AG. Acute infarcts. In: Osborn AG, editor. *Diagnostic neuroradiology*. 1st edn. St. Louis: Mosby-Year Book; 1994. p. 343–49.
28. Osborn AG. Miscellaneous acquired basal ganglia disorders. In: Osborn AG, editor. *Diagnostic neuroradiology*. 1st edn. St. Louis: Mosby-Year Book; 1994. p. 775–7.
29. Dietrich RB, Bradley WG. Iron accumulation in the basal ganglion following severe ischemic-anoxic insults in children. *Radiology* 1988;168:203–6.
30. Fujioka M, Taoka T, Hiramatsu KI, Sakaguchi S, Sakaki T. Delayed ischemic hyperintensity on T1-weighted MRI in the caudoputamen and cerebral cortex of humans after spectacular shrinking deficit. *Stroke* 1999;30:1038–42.
31. Fujioka M, Taoka T, Matsuo Y, Hiramatsu KI, Sakaki T. Novel brain ischemic change on MRI: delayed ischemic hyperintensity on T1-weighted images and selective neuronal death

in the caudoputamen of rats after brief focal ischemia. *Stroke* 1999;30:1043-6.

32. Fujioka M, Taoka T, Matsuo Y, Mishima K, Ogoshi K, Kondo Y, et al. Magnetic resonance imaging shows delayed ischemic striatal neurodegeneration. *Ann Neurol* 2003;54:732-47.

33. Barkovich AJ. Diffuse ischemic brain injury. In: Barkovich AJ, editor. *Pediatric neuroimaging*. 4th edn. Philadelphia: Lippincott Williams & Wilkins; 2005. p. 203-44.

34. Liu XH, Kato H, Itoyama Y, Kato K, Kosuge K. An immunohistochemical study of copper/zinc superoxide dismutase and manganese superoxide dismutase following focal cerebral ischemia in the rat. *Brain Res* 1994;644:257-66.

35. Kondo Y, Ogawa N, Asamura M, Ota Z, Mori A. Regional differences in late-onset iron deposition, ferritin, transferring, astrocyte proliferation, and microglial activation after transient forebrain ischemia in rat brain. *J Cereb Flow Metab* 1995;15:216-26.

36. Gossuin Y, Roch A, Muller RN, Gillis P. Relaxation induced by ferritin and ferritin-like magnetic particles: the role of proton exchange. *Magn Reson Med* 2000;43:237-43.

37. Henkelman RM, Hardy PA, Bishop JE, Poon CS, Plewes DB. Why fat is bright in RARE and fast spin-echo imaging. *J Magn Reson Imaging* 1992;2:533-40.

38. Bloembergen N, Purcell EM, Pound RV. Relaxation effects in nuclear magnetic resonance absorption. *Phys Rev* 1948;73:679-712.

39. Burdette JH, Elster AD, Ricci PE. Acute cerebral infarction: quantification of spin-density and T2 shine-through phenomena on diffusion-weighted MR images. *Radiology* 1999;212:333-9.

40. Helenius J, Soenne L, Perkiö J, Salonen O, Kangasmäki A, Kaste M, et al. Diffusion-weighted MR imaging in normal human brains in various age groups. *AJNR Am J Neuroradiol* 2002;23:194-9.

41. Wijdicks EFM, Campeau NG, Miller GM. MR imaging in comatose survivors of cardiac resuscitation. *AJNR Am J Neuroradiol* 2001;22:1561-5.

42. Arbelaez A, Castillo M, Mukherji SK. Diffusion-weighted MR imaging of global cerebral anoxia. *AJNR Am J Neuroradiol* 1999;20:999-1007.

43. Sener RN. Diffusion MRI in the postmortem brain: case report. *J Neuroradiol* 2004;31:406-8.

44. Anzai Y, Ishikawa M, Shaw DWW, Artru A, Yarnykh V, Maravilla KR. Paramagnetic effect of supplemental oxygen on CSF hyperintensity on fluid-attenuated inversion recovery MR images. *AJNR Am J Neuroradiol* 2004;25:274-9.

45. Ith M, Bigler P, Scheurer E, Kreis R, Hofmann L, Dirnhöfer R, et al. Observation and identification of metabolites emerging during postmortem decomposition of brain tissue by means of in situ <sup>1</sup>H-magnetic resonance spectroscopy. *Magn Reson Med* 2002;48:915-20.

# Autopsy オートプシー・イメージング imaging ガイドライン



日本放射線科専門医会・医会 AI ワーキンググループ  
社団法人 日本放射線技師会 AI 活用検討委員会

AI



