Supplemental Table 1

Characteristics of patients with SAH-induced neurogenic stunned myocardium

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Comorbidities | Clinical presentation |  | ECG findings |
| Reference | Age | Sex | Cad | Dm | Htn | AMS | HA | CP | Fisher Grade | TWA | ST  | QT Pro | CEElev | EF (%) | EF (%) On FU | NSM Type | Cor Angio | Clip/ Coil | SAH Tx Delay | Hospital Mortality | mRS Score |
| Ono et al, 2004[1](#_ENREF_1) | 66 | f | n | n | n | y | n | n | 4 | y | y | y | y | 28 | nl | classic | y | clip | n | n | na |
| Ennezat et al, 2005[2](#_ENREF_2) | 34 | m | n | n | n | y | y | y | 4 | y | y | n | y | 30 | na | var- invert | y | none | n | y | 6 |
| de Chazal[3](#_ENREF_3" \o "de Chazal, 2005 #4706) | 55 | f | n | n | n | y | y | n | WFNS grade 4 | n | y | n | n | 33 | 60 | classic | y | coil | yes | n | Cognitive impairment |
|  | 29 | m | n | n | n | y | y | n | 4 | y | n | n | y | 20 | na | var- invert | n | coil | n | y | 6 |
| Deininger et al, 2006[4](#_ENREF_4) | 23 | m | na | na | na | y | n | n | 4 | y | y | n | y | 15 | 65 | classic | n | none | n | n | 5\* |
| Lee et all, 2006[5](#_ENREF_5) | 44 | f | n | n | n | y | n | n | HH 2 | y | n | n | na | 40 | 67 | classic | n | clip | n | n | 0 |
|  | 71 | f | n | n | n | n | n | n | HH 3 | y | n | n | na | 46 | 55 | classic | n | clip | n | n | 6 |
|  | 57 | f | n | y | y | y | n | n | HH 3 | y | y | n | y | 55 | 68 | classic | n | clip | n | n | na |
|  | 66 | f | n | n | n | y | n | n | HH 3 | n | n | n | y | 30 | 40 | classic | n | coil | n | n | 1 |
|  | 54 | f | n | y | y | y | n | n | HH 4 | y | n | n | y | 30 | 54 | classic | n | coil | n | n | 0 |
|  | 55 | f | n | n | n | n | n | n | HH 3 | y | n | n | y | 45 | 50 | classic | n | coil | n | y | 6 |
|  | 38 | f | n | n | y | y | n | n | HH 4 | y | n | n | y | 25 | 55 | var- diffuse | n | clip | n | n | 2 |
|  | 55 | f | n | n | y | y | n | n | HH 4 | n | n | n | y | 33 | 55 | var- diffuse | n | coil | n | n | 0 |
| Inoue et al, 2006[6](#_ENREF_6) | 56 | m | n | n | n | y | y | na | na | y | y | n | y | 20 | 64 | classic | y | clip | n | n | 3\* |
|  | 48 | f | n | n | n | y | y | na | na | n | y | n | y | 21 | 62 | var- diffuse | y | clip | n | n | 4\* |
| Otomo et al, 2006[7](#_ENREF_7) | 74 | f | n | n | n | y | n | n | HH 4 | y | n | n | y | 13 | 60 | classic | n | clip | n | n | na |
|  | 75 | f | n | n | y | y | n | n | HH 2 | y | n | n | y | 26 | 70 | classic | n | clip | n | n | na |
| Miljak et al, 2007[8](#_ENREF_8) | 40 | f | n | n | n | y | y | n | 4 | y | y | n | y | 30\* | na | classic | y | none | y | y | 6\* |
| D’Aloia et al, 2007[9](#_ENREF_9) | 69 | f | n | n | y | y | n | y | na | y | y | y | y | 35 | nl | classic | y | clip | y | n | 0\* |
| Hakeem et all, 2007[10](#_ENREF_10) | 64 | f | n | n | n | y | n | y | 4 | y | y | y | y | 25 | nl | classic | n | na | n | n | na |
| Inoue et all, 2007[11](#_ENREF_11) | 53 | m | n | n | n | y | n | n | na | y | y | n | y | 50 | 80 | var- mid | y | coil | n | n | 0\* |
| Fujita et al, 2007[12](#_ENREF_12) | 35 | f | na | na | na | na | y | y | 1 | n | n | n | n | 33 | na | classic | n | na | n | n | 0\* |
|  | 60 | f | na | na | na | na | na | n | 3 | y | y | na | y | 10 | na | classic | n | na | n | n | 2\* |
|  | 72 | f | n | n | n | y | y | n | 3 | y | y | na | y | 51 | nl | classic | y | clip | n | n | 0\* |
|  | 66 | f | n | n | n | na | na | n | 4 | y | y | na | y | 21 | na | classic | n | na | y | n | 2\* |
|  | 64 | f | n | n | y | na | na | n | 3 | y | y | na | y | 14 | na | classic | n | clip | y | y | 6\* |
|  | 79 | f | n | n | n | na | na | n | 4 | y | n | na | y | 20 | na | classic | n | na | y | y | 6\* |
| Bonnemeier et al, 2008[13](#_ENREF_13) | 62 | m | n | na | na | y | y | n | ICH | y | y | n | y | 29 | na | classic | y | na | n | n | na |
| Rahimi et al, 2008[14](#_ENREF_14) | 70 | f | y | y | na | y | na | na | ICH | y | y | n | y | 51 | nl | classic | y | none | y | n | na |
| Tommaso et al, 2008[15](#_ENREF_15) | 36 | f | n | n | n | y | y | y | 4 | y | n | n | y | na | nl | classic | y | coil | n | n | 0\* |
| Yamaguchi et al, 2008[16](#_ENREF_16) | 57 | f | n | n | n | n | y | n | 4 | y | y | n | n | 32 | 56 | var- mid | y | coil | n | n | na |
| Das et al, 2009[17](#_ENREF_17) | 57 | f | n | n | n | y | y | n | 5 | y | n | n | y | na | nl | classic | y | coil | n | n | na |
| Franco et al, 2010[18](#_ENREF_18) | na | f | na | na | na | y | na | na | 4 | y | n | y | y | 20 | 45 | classic | n | coil | n | n | na |
| Suzuki et al, 2010[19](#_ENREF_19) | 63 | f | n | n | y | y | n | n | 3 | y | y | n | y | 50 | nl | classic | n | coil | n | n | 0\* |
| Cardin et al, 2011[20](#_ENREF_20) | 64 | f | n | na | na | y | n | n | na | na | y | y | y | na | na | var- mid | y | na | na | y | 6 |
| Hamdan et al, 2010[21](#_ENREF_21) | 55 | f | n | na | y | n | y | y | na | na | y | n | y | 35 | nl | classic | y | clip | n | n | na |
| Smedra et al, 2010[22](#_ENREF_22) | 57 | m | n | na | na | y | na | na | na | y | y | n | y | 25 | na | classic | y | none | n | y | 6 |
| Konrad et al, 2010[23](#_ENREF_23) | 77 | f | n | na | na | na | na | na | na | na | na | na | y | na | nl | classic | y | coil | y | n | 5\* |
| Abed et al, 2010[24](#_ENREF_24) | 62 | f | y | na | y | y | na | na | na | y | na | na | y | na | nl | var-invert | y | coil | y | n | na |
| Ando et al, 2010[25](#_ENREF_25) | 43 | f | n | n | n | y | y | n | 4 | y | y | y | y | 35 | 60 | classic | y | coil | yes | n | na |
|  | 64 | f | n | n | n | y | y | n | 4 | y | y | y | y | 35 | 60 | classic | y | coil | yes | n | na |
| Boes et all, 2011[26](#_ENREF_26) | 64 | f | n | na | na | y | na | na | 3 | na | na | na | na | 20 | nl | classic | y | clip | y | n | 5\* |
| Bagga et al, 2011[27](#_ENREF_27) | 65 | f | n | n | n | y | y | y | 3 | n | y | n | y | 35 | nl | classic | y | clip | y | n | na |
| Gaibazzi t al, 2011[28](#_ENREF_28) | na | na | na | na | na | na | na | na | na | na | na | na | na | na | na | var-mid | na | na | na | na | na |
|  | na | na | na | na | na | na | na | na | na | na | na | na | na | na | na | var-invert | na | na | na | na | na |
| Santana-Cabrera et al, 2012[29](#_ENREF_29) | 47 | f | n | n | n | y | y | n | 4 | y | y | y | y | 35 | 60 | classic | n | clip | yes | n | na |
| Inamasu et al, 2012[30](#_ENREF_30) | 62 | f | n | n | n | y | y | n | 3 | Y | y | Y | na | 35 | 60 | classic | na | clip | N | N | 5 |
|  | 70 | f |  |  |  | y | y | n | 4 | N | y | Y | na | 35 | 60 | classic | na | coil | N | N | 4 |
|  | 59 | m | n | n | n | y | y | n | 4 | N | y | Y | na | 35 | 60 | classic | na | coil | N | N | 5 |
|  | 58 | f |  |  |  | y | y | n | 3 | Y | y | Y | na | 35 | 60 | classic | na | clip | N | N | 4 |
|  | 46 | f | n | n | n | y | y | n | 4 | N | y | Y | na | 35 | 60 | classic | na | coil | N | Y | 1 |
|  | 44 | f |  |  |  | y | y | n | 4 | N | y | N | na | 35 | 60 | classic | na | coil | N | N | 4 |
|  | 59 | f | n | n | n | y | y | n | 4 | N | y | Y | na | 35 | 60 | classic | na | coil | N | Y | 1 |
|  | 52 | m |  |  |  | y | y | n | 4 | N | y | N | na | 35 | 60 | classic | na | coil | N | y | 1 |
|  | 54 | m | n | n | n | y | y | n | 4 | Y | y | Y | na | 35 | na | classic | na | NS | Y | Y | 1 |
|  | 76 | m |  |  |  | y | y | n | 4 | N | y | N | na | 35 | na | classic | na | NS | Y | Y | 1 |
|  | 62 | m | n | n | n | y | y | n | 4 | N | y | N | na | 35 | na | classic | na | NS | Y | Y | 1 |
|  | 75 | f |  |  |  | y | y | n | 4 | N | y | Y | na | 35 | na | classic | na | NS | Y | Y | 1 |
|  | 64 | f | n | n | n | y | y | n | 4 | n | y | Y | na | 35 | na | classic | na | NS | Y | Y | 1 |
|  | 79 | f | n | n | n | y | y | n | 4 | n | y | y | na | 35 | na | classic | na | NS | Y | y | 1 |
| Shoukar et al, 2013[31](#_ENREF_31) | 63 | f | n | n | y | y | y | n | HH 3 | n | y | n | y | 40 | 55 | var- invert | y | coil | n | n | na |
|  | 44 | f | n | n | n | y | y | n | HH5 | y | y | n | y | 20 | na | var- invert | y | ns | y | y | 1 |
|  | 47 | f | n | n | n | y | y | n | HH5 | y | y | y | y | 20 | na | var- invert | y | ns | y | y | 1 |
|  | 43 | f | n | n | y | y | y | n | HH5 | y | y | y | y | 20 | 60 | var- invert | y | ns | y | y | 1 |
| Waller et al, 2013[32](#_ENREF_32) | 46 | f | n | n | y | y | n | n | HH3 | n | y | n | y | 25 | 65 | var- invert | n | coil | n | n | good |
| Edwards et al., 2013 | 23 | f | n | n | n | y | y | n | 3 | n | n | n | y | 25 | 55 | var- invert | n | coil | n | n | 2 |

This supplemental table shows detailed characteristics of patients with SAH-induced neurogenic stunned myocardium. In August 2014 we identified relevant publications through a PubMed search using the keywords “tako-tsubo cardiomyopathy”, “takotsubo”, “takotsubo cardiomyopathy”,“apical ballooning syndrome”, “stress-induced cardiomyopathy”, “broken heart syndrome”, “neurogenic stunned myocardium” and “ampulla cardiomyopathy” in combination with “variant form”, “inverse form“, “basal form” and “subarachnoid hemorrhage”. Further studies were sought by means of manual search of secondary sources, including references from primary articles. For each case, we collected (when described) the demographic and clinical information, including age, sex, neurological diagnosis, electrocardiographic (ECG) changes, cardiac enzymes, LV ejection fraction (EF) and the detail of wall motion abnormalities.

*a.* AMS, altered mental status; CAD, coronary artery disease; Cor angio, coronary angiography performed; CP, chest pain; CE elev, cardiac enzymes elevated (includes troponin, CK, and CKMB); DM, diabetes mellitus; EF, ejection fraction; f,female; FU, follow-up; HA, headache; HH, Hunt & Hess grade; HTN, hypertension; m,male; mRS, Modified Rankin Scale; n,no; na,not available; nl,normal form; NSM, neurogenic stunned myocardium; QT pro, QT prolongation; ST , ST segment changes; TWA, T-wave abnormalities; var,variant form; y,yes

*b.* ^ = reported as fractional shortening and not ejection fraction

*c.* \* = inferred value based on history

1. Ono Y, Kawamura T, Ito J, Kanayama S, Miura T, Kikuchi F. Ampulla (takotsubo) cardiomyopathy associated with subarachnoid hemorrhage worsening in the late phase of vasospasm--case report. Neurol Med Chir (Tokyo) 2004;44:72-4.

2. Ennezat PV, Pesenti-Rossi D, Aubert JM, Rachenne V, Bauchart JJ, Auffray JL, Logeart D, Cohen-Solal A, Asseman P. Transient left ventricular basal dysfunction without coronary stenosis in acute cerebral disorders: a novel heart syndrome (inverted Takotsubo). Echocardiography 2005;22:599-602.

3. de Chazal I, Parham WM, 3rd, Liopyris P, Wijdicks EF. Delayed cardiogenic shock and acute lung injury after aneurysmal subarachnoid hemorrhage. Anesth Analg 2005;100:1147-9.

4. Deininger MH, Radicke D, Buttler J, Scheufler KM, Freiman T, Zentner JF. Tako-tsubo cardiomyopathy: reversible heart failure with favorable outcome in patients with intracerebral hemorrhage. Case report. J Neurosurg 2006;105:465-7.

5. Lee VH, Connolly HM, Fulgham JR, Manno EM, Brown RD, Wijdicks EF. Tako-tsubo cardiomyopathy in aneurysmal subarachnoid hemorrhage: an underappreciated ventricular dysfunction. J Neurosurg 2006;105:264-70.

6. Inoue F, Tsuzuki T, Thoma Y, Shiono S, Tabuse H, Hoshida T, Saito Y. [Subarachnoid hemorrhage complicated with different manifestations of transient abnormal left ventricular wall motion: two case reports]. J Cardiol 2006;47:245-54.

7. Otomo S, Sugita M, Shimoda O, Terasaki H. Two cases of transient left ventricular apical ballooning syndrome associated with subarachnoid hemorrhage. Anesth Analg 2006;103:583-6.

8. Miljak T, Birkemeyer R, Jung W. [A 40-year-old female with headache and infarction ECG]. Internist (Berl) 2007;48:1151-6.

9. D'Aloia A, Vizzardi E, Faggiano P, Fiorina C, Cas LD. Intracranial bleeding mimicking an extensive acute myocardial infarction with reversible apical ballooning and systolic left ventricular dysfunction. A case report. Monaldi Archives for Chest isease 2007;68:44-7.

10. Hakeem A, Marks AD, Bhatti S, Chang SM. When the worst headache becomes the worst heartache! Stroke 2007;38:3292-5.

11. Inoue M, Taniguchi T, Goto Y, Ohta K, Hirota Y, Hamada J, Yamagishi M, Inaba H. Unusual abnormal left ventricular contraction pattern associated with subarachnoid hemorrhage. Intensive Care Med 2007;33:2036-7.

12. Fujita K, Fukuhara T, Munemasa M, Numba Y, Kuyama H. Ampulla cardiomyopathy associated with aneurysmal subarachnoid hemorrhage: report of 6 patients. Surg Neurol 2007;68:556-61; discussion 61.

13. Bonnemeier H, Krauss T, Brunswig K, Burgdorf C. Severe headache and a broken heart. Europace 2008;10:1115-6.

14. Rahimi AR, Katayama M, Mills J. Cerebral hemorrhage: precipitating event for a tako-tsubo-like cardiomyopathy? Clin Cardiol 2008;31:275-80.

15. Tommaso ID, Ossana R, Polosa D, Mecca D. Takotsubo Cardiomyopathy After Subarachnoid Hemorrhage: A Case Report. The Internet Journal of Neurosurgery 2008;5.

16. Yamaguchi K, Wakatsuki T, Kusunose K, Niki T, Koshiba K, Yamada H, Soeki T, Akaike M. A case of neurogenic myocardial stunning presenting transient left ventricular mid-portion ballooning simulating atypical takotsubo cardiomyopathy. J Cardiol 2008;52:53-8.

17. Das M, Gonsalves S, Saha A, Ross S, Williams G. Acute subarachnoid haemorrhage as a precipitant for takotsubo cardiomyopathy: a case report and discussion. Int J Cardiol 2009;132:283-5.

18. Franco C, Khaled B, Afonso L, Raufi M. Acute Subarachnoid Hemorrhage and Cardiac Abnormalities: Takotsubo Cardiomyopathy or Neurogenic Stunned Myocardium? a case report. Cases J 2010;3:81.

19. Suzuki H, Sakurai M, Fujimoto M, Tsuchiya T, Sakaida H, Taki W. Complete recovery from aneurysmal subarachnoid hemorrhage associated with out-of-hospital cardiopulmonary arrest. Eur J Emerg Med 2010;17:42-4.

20. Cardin C, Roncalli J, Lairez O, Austruy J, Elbaz M, Carrie D, Galinier M. Subarachnoid haemorrhage associated with midventricular Tako-Tsubo syndrome. Int J Cardiol 2011;146:e46-8.

21. Hamdan R, Kadri Z, Kassab R, Abou Jaoude S. [Cerebral aneurysm and subarachnoid hemorrhage revealed by a Tako Tsubo syndrome]. Ann Cardiol Angeiol (Paris) 2010;59:34-6.

22. Smedra-Kazmirska A, Barzdo M, Kowalski J, Szram S, Berent J. [Tako-tsubo cardiomyopathy in a man with cerebral haemorrhage]. Anestezjol Intens Ter 2010;42:85-9.

23. Konrad FM, Unertl KE, Schroeder TH. Takotsubo cardiomyopathy after cerebral aneurysm rupture. J Neurosurg Anesthesiol 2010;22:181-2.

24. Abed H, Barlow M, Wellings T, Spratt N, Collins N. Cardiogenic shock complicating subarachnoid haemorrhage diagnosed as Tako Tsubo cardiomyopathy: a cautionary tale. Heart Lung Circ 2010;19:476-9.

25. Ando G, Trio O, de Gregorio C. Transient left ventricular dysfunction in patients with neurovascular events. Acute Card Care 2010;12:70-4.

26. Boes M, Henning M, Urbach H, Simon M. Delayed diagnosis of subarachnoid hemorrhage associated with Tako-tsubo cardiomyopathy. Cent Eur Neurosurg 2011;72:49-51.

27. Bagga S, Sharma YP, Jain M. Cardiac dysfuntion after acute subarachnoid hemorrhage: neurogenic stress cardiomyopathy or takotsubo cardiomyopathy. Neurol India 2011;59:304-6.

28. Gaibazzi N, Vezzani A, Concari P, Malchiodi L, Reverberi C. Rare and atypical forms of Tako-Tsubo cardiomyopathy diagnosed by contrast-echocardiography during subarachnoid haemorrhage: confirming the appropriateness of the new Tako-Tsubo classification. Int J Cardiol 2011;149:115-7.

29. Santana-Cabrera L, Rodriguez Escot C, Medina Gil JM, Perez Ortiz C. Takotsubo cardiomyopathy associated with acute subarachnoid hemorrhage. J Emerg Med 2012;42:586-7.

30. Inamasu J, Nakatsukasa M, Mayanagi K, Miyatake S, Sugimoto K, Hayashi T, Kato Y, Hirose Y. Subarachnoid hemorrhage complicated with neurogenic pulmonary edema and takotsubo-like cardiomyopathy. Neurol Med Chir (Tokyo) 2012;52:49-55.

31. Shoukat S, Awad A, Nam DK, Hoskins MH, Samuels O, Higginson J, Clements SD, Jr. Cardiomyopathy with inverted tako-tsubo pattern in the setting of subarachnoid hemorrhage: a series of four cases. Neurocrit Care 2013;18:257-60.

32. Waller CJ, Vandenberg B, Hasan D, Kumar AB. Stress cardiomyopathy with an "inverse" takotsubo pattern in a patient with acute aneurysmal subarachnoid hemorrhage. Echocardiography 2013;30:E224-6.