**Supplemental digital content**

**Supplementary methods.** Data cleaning and quality control

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**Figure S2.** Dotplot showing A) diameter of pseudoaneurysm, and B) distance from spleen/liver capsule to pseudoaneurysm by AAST grade of injury (1994 version)

**Supplementary methods.** Data cleaning and quality control

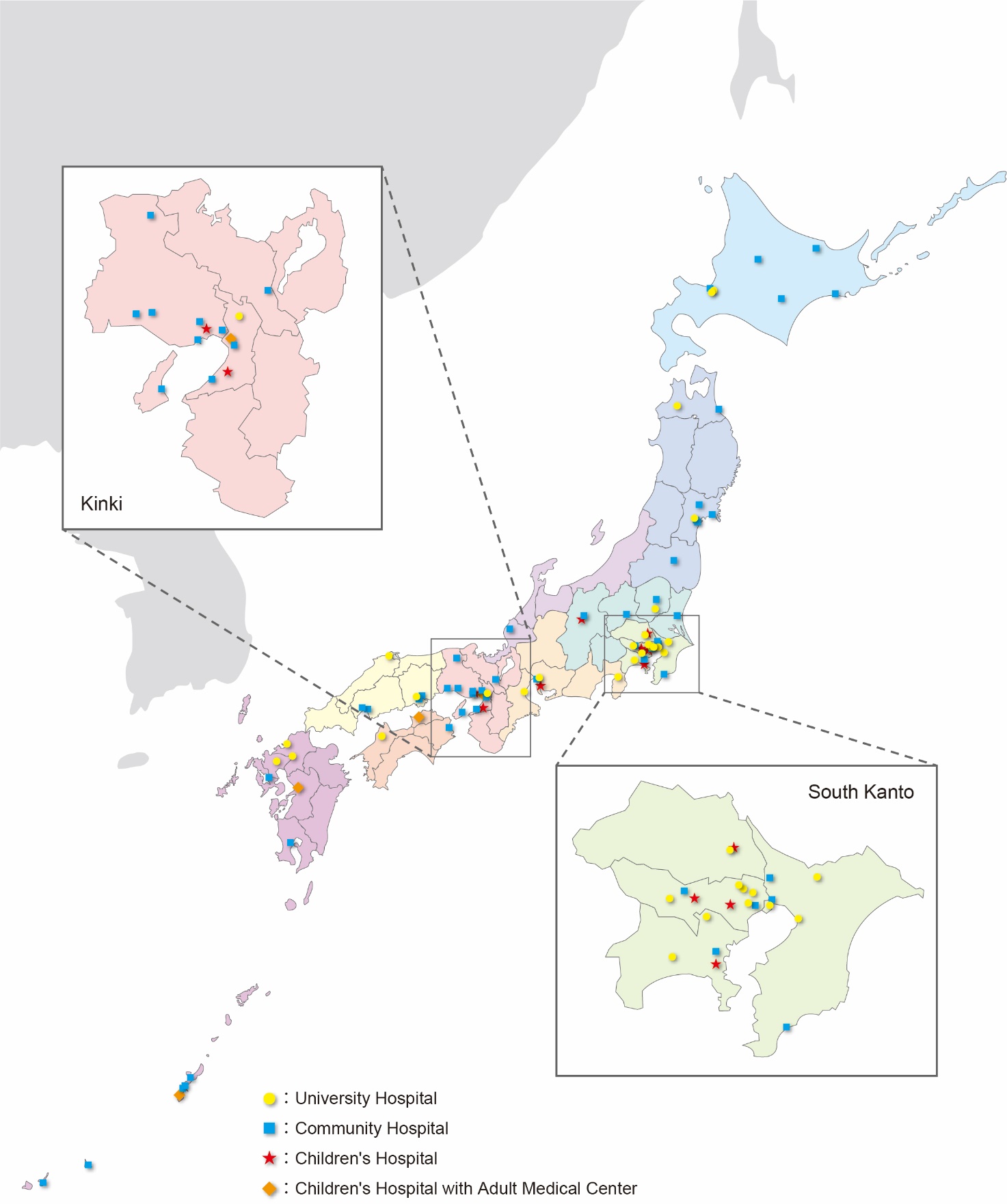
Study data were collected and managed through the REDCap (Research Electronic Data Capture, Vanderbilt University, Nashville, TN) tool hosted at Kameda Medical Center, Chiba, Japan. REDCap is a secure, web-based software platform designed to support data capture for research studies. Data registered in REDCap were grouped according to the timing of completed data registration, and data entry errors were checked according to a pre-developed data cleaning logic.30,31 All facilities were requested to perform this data cleaning process at least twice to crosscheck for inconsistencies, outliers, and missing data by the research investigator per site and correct them. The cleaning logic was updated each time, and the final data cleaning process was conducted simultaneously at all facilities after the data registration of all enrolled cases was completed. This repeated data cleaning for quality control allowed for differences in the quality of data collection between the 83 participating centers to be corrected before data locking.31,32 All items corrected in the data cleaning process were kept on record.

**References**

31. Van den Broeck J, Cunningham SA, Eeckels R, Herbst K. Data cleaning: detecting, diagnosing, and editing data abnormalities. *PLoS Med*. 2005;2(10):e267.

32. Caloto T; Multicentre Project for Tuberculosis Research Study Group. Quality control and data-handling in multicentre studies: the case of the Multicentre Project for Tuberculosis Research. *BMC Med Res Methodol*. 2001;1:14.

**Figure S1.** Geographical distribution of the participating centers in this study



**Table S1.** A list of the participating centers and site principal investigators in this study (in alphabetical order by site)

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Institution name** | **Site principal investigators** | |
| 1 | Aichi Children's Health and Medical Center | Tomoya Ito |  |
| 2 | Aizawa Hospital | Motoyoshi Yamamoto | Yoshihiro Yamamoto |
| 3 | Asahikawa Red Cross Hospital | Hiroto Manase |  |
| 4 | Chiba University Hospital | Nozomi Takahashi |  |
| 5 | Chukyo Hospital | Akinori Osuka |  |
| 6 | Ehime University Hospital | Suguru Annen |  |
| 7 | Fukui Prefectural Hospital | Nobuki Ishikawa |  |
| 8 | Fukuoka University Hospital | Kazushi Takayama |  |
| 9 | Hachinohe City Hospital | Keita Minowa |  |
| 10 | Hirosaki University Hospital | Kenichi Hakamada |  |
| 11 | Hiroshima Prefectural Hospital | Akari Kusaka |  |
| 12 | Hokkaido university hospital | Mineji Hayakawa | Shota Kawahara |
| 13 | Hyogo Emergency Medical Center | Marika Matsumoto |  |
| 14 | Hyogo Prefectural Amagasaki General Medical Center | Kohei Kusumoto |  |
| 15 | Hyogo Prefectural Awaji Medical Center | Hiroshi Kodaira |  |
| 16 | Hyogo Prefectural Kakogawa Medical Center | Chika Kunishige |  |
| 17 | Hyogo Prefectural Kobe Children's Hospital | Keiichiro Toma | Yusuke Seino |
| 18 | Ishinomaki Red Cross Hospital | Michio Kobayashi |  |
| 19 | JA Hiroshima General Hospital | Masaaki Sakuraya |  |
| 20 | Jichi Medical University Hospital | Takafumi Shinjo | Shigeru Ono |
| 21 | Jichi Medical University Saitama Medical Center | Hideto Yasuda | Haruka Taira |
| 22 | Juntendo University Shizuoka Hospital | Kazuhiko Omori |  |
| 23 | Juntendo University Urayasu Hospital | Yutaka Kondo |  |
| 24 | Kagoshima City Hospital | Yoshio Kamimura |  |
| 25 | Kameda Medical Center | Atsushi Shiraishi | Rei Tanaka |
| 26 | Kanagawa Children's Medical Center | Yukihiro Tsuzuki |  |
| 27 | Keio University Hospital | Yukio Sato |  |
| 28 | Kitami Red Cross Hospital | Noriaki Kyogoku |  |
| 29 | Kobe City Medical Center General Hospital | Masafumi Onishi | Kaichi Kawai |
| 30 | Japanese Red Cross Kumamoto Hospital | Kazuyuki Hayashida | Keiko Terazumi |
| 31 | Kurashiki Central Hospital | Akira Kuriyama | Susumu Matsushime |
| 32 | Kurume University Hospital | Osamu Takasu | Toshio Morita |
| 33 | Kushiro City General Hospital | Nagato Sato |  |
| 34 | Kyoto Second Red Cross Hospital | Wataru Ishii | Michitaro Miyaguni |
| 35 | Maebashi Red Cross Hospital | Yosuke Nakabayashi | Yoshimi Ohtaki |
| 36 | Matsudo City General Hospital | Kiyoshi Murata | Masayuki Yagi |
| 37 | Mie University Hospital | Tadashi Kaneko |  |
| 38 | Nagano Children's Hospital | Shigeru Takamizawa |  |
| 39 | Nagoya University Hospital | Akihiro Yasui |  |
| 40 | Nakagami Hospital | Yasuaki Mayama |  |
| 41 | National Center for Child Health and Development | Masafumi Gima |  |
| 42 | National Hospital Organization Disaster Medical Center | Ichiro Okada |  |
| 43 | National Hospital Organization Mito Medical Center | Asuka Tsuchiya | Koji Ishigami |
| 44 | National Hospital Organization Nagasaki Medical Center | Yukiko Masuda |  |
| 45 | National Hospital Organization Sendai Medical Center | Yasuo Yamada |  |
| 46 | Nippon Medical School Chiba Hokusoh Hospital | Hiroshi Yasumatsu |  |
| 47 | Nippon Medical School Hospital | Kenta Shigeta |  |
| 48 | Obihiro Kosei Hospital | Kohei Kato |  |
| 49 | Ohta Nishinouchi Hospital | Fumihito Ito |  |
| 50 | Okayama Red Cross Hospital | Atsuyoshi Iida |  |
| 51 | Okayama University Hospital | Tetsuya Yumoto | Hiromichi Naito |
| 52 | Okinawa Chubu Hospital | Morihiro Katsura | Yoshitaka Saegusa |
| 53 | Okinawa Hokubu Hospital | Tomohiko Azuma |  |
| 54 | Okinawa Miyako Hospital | Shima Asano |  |
| 55 | Okinawa Nanbu Medical Center & Children's Medical Center | Takehiro Umemura | Norihiro Goto |
| 56 | Okinawa Yaeyama Hospital | Takao Yamamoto |  |
| 57 | Osaka City General Hospital | Junichi Ishikawa |  |
| 58 | Osaka Red Cross Hospital | Elena Yukie Uebayashi |  |
| 59 | Osaka University Hospital | Shunichiro Nakao |  |
| 60 | Osaka Women's and Children's Hospital | Yuko Ogawa |  |
| 61 | Osaki Citizen Hospital | Takashi Irinoda |  |
| 62 | Rinku General Medical Center | Yuki Narumi |  |
| 63 | Saga University Hospital | Miho Asahi |  |
| 64 | Saiseikai Utsunomiya Hospital | Takayuki Ogura | Takashi Hazama |
| 65 | Saiseikai Yokohamashi Tobu Hospital | Shokei Matsumoto |  |
| 66 | Saitama Children's Medical Center | Daisuke Miyamoto |  |
| 67 | Sapporo Medical University Hospital | Keisuke Harada | Narumi Kubota |
| 68 | Sendai City Hospital | Yusuke Konda |  |
| 69 | Shikoku Medical Center for Children and Adults | Takeshi Asai |  |
| 70 | Shimane University Hospital | Tomohiro Muronoi |  |
| 71 | St. Luke's International Hospital | Toru Hifumi | Kasumi Shirasaki |
| 72 | St. Marianna University School of Medicine Hospital | Shigeyuki Furuta | Atsuko Fujikawa |
| 73 | Steel Memorial Hirohata Hospital | Makoto Takaoka |  |
| 74 | Teikyo University Hospital | Kaori Ito |  |
| 75 | Teine Keijinkai Hospital | Satoshi Nara |  |
| 76 | Tohoku University Hospital | Shigeki Kushimoto | Atsushi Tanikawa |
| 77 | Tokai University Hachioji Hospital | Masato Tsuchikane |  |
| 78 | Tokai University Hospital | Naoya Miura | Naoki Sakoda |
| 79 | Tokushima Red Cross Hospital | Tadaaki Takada |  |
| 80 | Tokyo Bay Urayasu Ichikawa Medical Center | Shogo Shirane |  |
| 81 | Tokyo Medical and Dental University Hospital of Medicine | Akira Endo | Keita Nakatsutsumi |
| 82 | Tokyo Metropolitan Children's Medical Center | Kenta Sugiura | Yusuke Hagiwara |
| 83 | Toyooka Hospital | Tamotsu Gotou |  |

**Table S2.** Patient and hospital characteristics of all participants by management group within 48 hours of admission (Additional information)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Management group by intervention within 48hr | | | |  |
|  | Overall cohort  (n = 1,407) | NOM  without IR  (n = 1,056) | NOM  with IR  (n = 276) | OM  (n = 53) | Combined IR/OM  (n = 22) | *P* value |
| **Laboratory data on admission** |  |  |  |  |  |  |
| Hb, median [IQR],  g/dL | 12.4  [11.3–13.3] | 12.5  [11.6–13.4] | 12.1  [11.0-13.2] | 11.0  [8.8-12.3] | 11.3  [9.5-12.1] | <0.001 |
| Hct, median [IQR],  % | 36.4  [33.5–39.0] | 36.7  [34.1–39.2] | 35.7  [32.5–38.7] | 32.7  [25.7–36.6] | 32.9  [26.9–35.6] | <0.001 |
| PLT count, median [IQR],  in ten thousands/mcL | 27.5  [22.5–33.3] | 28.2  [23.1-34.3] | 26.0  [22.0-31.1] | 22.2  [16.1-28.1] | 22.0  [17.1-33.1] | <0.001 |
| INR, median [IQR] | 1.10  [1.04–1.19] | 1.09  [1.03–1.16] | 1.15  [1.07–1.25] | 1.25  [1.13–1.70] | 1.32  [1.12–1.48] | <0.001 |
| **Imaging data on admission** |  |  |  |  |  |  |
| Hemoperitoneum volume\*, n (%) |  |  |  |  |  | <0.001 |
| zero | 533 (38%) | 495 (47%) | 37 (13%) | 1 (2%) | 0 (0%) |  |
| small volume | 325 (23%) | 257 (24%) | 63 (23%) | 3 (6%) | 2 (9%) |  |
| moderate volume | 242 (17%) | 164 (16%) | 68 (25%) | 8 (15%) | 2 (9%) |  |
| large volume | 307 (22%) | 140 (13%) | 108 (39%) | 41 (77%) | 18 (82%) |  |
| **Hospital characteristics, n (%)** |  |  |  |  |  | <0.001 |
| University hospital (adult center) | 403 (29%) | 274 (26%) | 107 (39%) | 17 (32%) | 5 (23%) |  |
| Community hospital (adult center) | 666 (47%) | 479 (45%) | 148 (54%) | 25 (47%) | 14 (64%) |  |
| Children's hospital | 209 (15%) | 190 (18%) | 10 (4%) | 7 (13%) | 2 (9%) |  |
| Mixed adult/pediatric center | 129 (9%) | 113 (11%) | 11 (4%) | 4 (8%) | 1 (5%) |  |
| **Primary service, n (%)** |  |  |  |  |  | <0.001 |
| Emergency medicine | 723 (51%) | 490 (46%) | 192 (70%) | 27 (51%) | 14 (64%) |  |
| Pediatric emergency medicine | 32 (2%) | 31 (3%) | 1 (0.4%) | 0 (0%) | 0 (0%) |  |
| General surgery | 218 (15%) | 162 (15%) | 40 (15%) | 11 (21%) | 5 (23%) |  |
| Pediatric surgery | 278 (20%) | 235 (22%) | 34 (12%) | 8 (15%) | 1 (5%) |  |
| Pediatric critical care | 131 (9%) | 117 (11%) | 5 (2%) | 7(13%) | 2 (9%) |  |
| Others | 25 (18%) | 21 (2%) | 4 (1%) | 0 (0%) | 0 (0%) |  |

Abbreviations: NOM, non-operative management; IR, interventional radiology; OM, operative management, Hb, hemoglobin; Hct, hematocrit; PLT, platelet; IQR, interquartile range; INR, International Normalized Ratio.

IQR presents the 25th and 75th percentiles, as appropriate.

P-values of the Table are for four-group comparisons using the Kruskal-Wallis test or chi-squared test.

\* Hemoperitoneum volume was estimated by totaling the number of intra-abdominal regions, which were adapted (right upper quadrant, left upper quadrant, right paracolic gutter, left paracolic gutter, and pelvis) when free fluid was identified on initial imaging. The definitions were: small, one region; moderate, two regions; large, three or more regions.

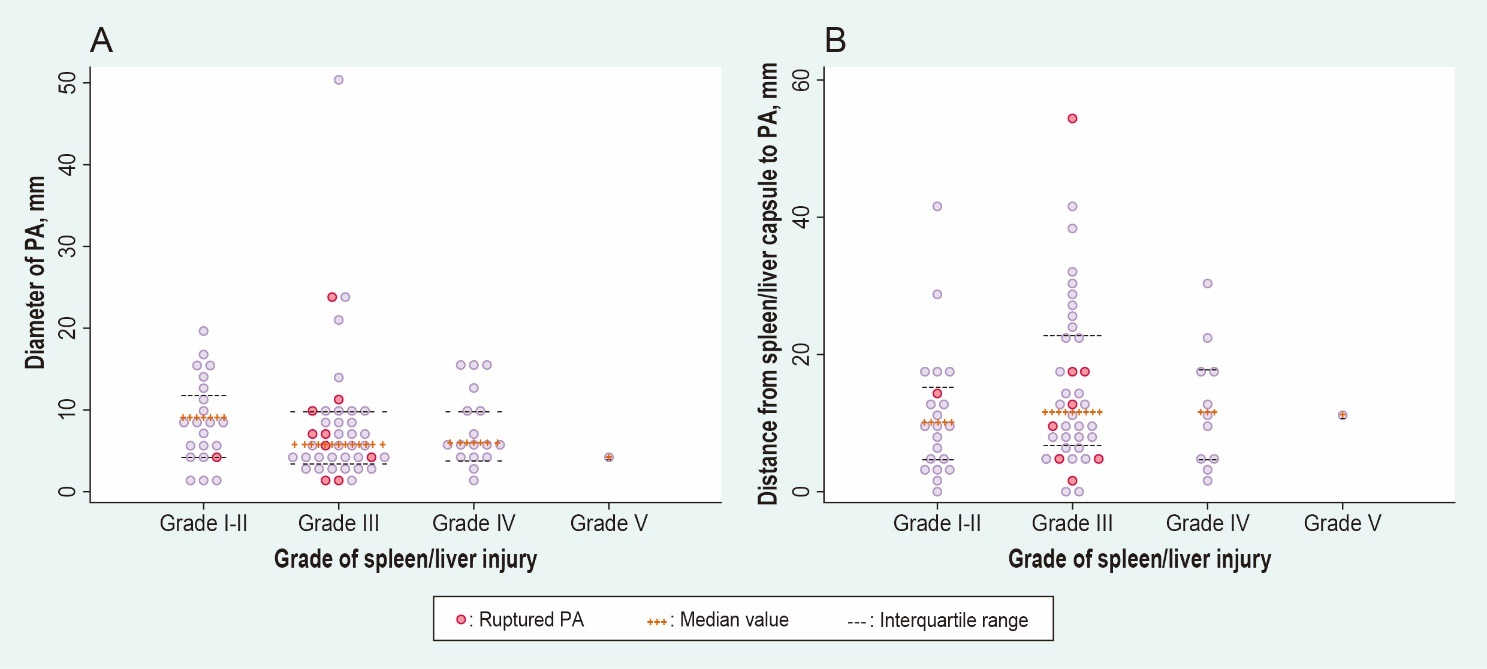
**Table S3.** Subgroup analysis: univariate comparison of delayed pseudoaneurysm formation by management group within 48 hours of admission

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Management group by intervention within 48hr | | | |  |
| **Subgroup**  Outcome | Overall cohort\*  (n = 1,353) | NOM  without IR  (n = 1,031) | NOM  with IR  (n = 258) | OM  (n = 46) | Combined IR/OM  (n = 18) | *P* value |
| **Spleen injury** |  |  |  |  |  |  |
| Delayed PA formation | 50/532 (9.4%) | 26/345 (7.5%) | 22/156 (14%) | 2/26 (7.7%) | 0/5 (0%) | <0.001 |
| **Liver injury** |  |  |  |  |  |  |
| Delayed PA formation | 29/821 (3.5%) | 16/686 (2.3%) | 10/102 (9.8%) | 0/20 (0%) | 3/13 (23%) | <0.001 |

Abbreviations: PA, pseudoaneurysm of splenic/hepatic artery; NOM, non-operative management; IR, interventional radiology; OM, operative management

\* Patients who sustained both liver and spleen injuries were excluded from this subgroup analysis because the organ in which the pseudoaneurysm originated could not be determined.

**Figure S2.** Dotplot showing A) diameter of pseudoaneurysm, and B) distance from spleen/liver capsule to pseudoaneurysm by AAST grade of injury (1994 version)



Abbreviations: PA, pseudoaneurysm of splenic and/or hepatic artery