**Online Resource**

Neurological manifestations of COVID-19: A systematic review

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**Table III: List of studies included in the systematic review for neurologic manifestations in COVID-19 patientsa**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author  month year | Study type | Total sample size | Diagnostic criteria/laboratory confirmation method | Neurological manifestation [n/N (%)] | | | | | | Remark |
| Headache | Dizziness | Smell dysfunction | Taste dysfunction | Impaired consciousness | Others |
| Chen et al1 Feb 2020b | Retrospective hospital-based single-center case series | 99 | WHO interim guideline/confirmed by RT-PCR on throat-swab | 8/99 (8.1) |  |  |  | Confusion: 9/99 (9.1) |  |  |
| Chen et al.2 March 2020b | Retrospective hospital-based single-center case series | 274 | Chinese guideline (6th edition)/confirmed by RT-PCR on throat swab | Total: 31/274 (11.3)  Survivors: 11/113 (9.7)  Non-survivors: 20/161 (12.4) | Total: 21/274 (7.7)  Survivors: 10/113 (8.8) Non-survivors: 20/161 (6.8) |  |  |  | Hypoxic encephalopathy 23/113 (20.4) | Data of survivors and non-survivors. Headache (total) excluded from table 1 due to overlap with Ref 15 (Qin et al.) |
| Deng et al.3 Feb 2020b | Retrospective case series based on reports released by official channels | 41 | Not provided | 2/41 (4.9), no separate data for headache and dizziness | |  |  |  |  | Data of non-survivors. |
| Duong et al.4  April 2020b | Case report | 1 | COVID-19 testing positive (not specified) | Yes |  |  |  | Yes | Meningoencephalitis presented with new onset seizure. EEG: Generalized slowing with no epileptic discharges. CSF: WBC: 70 (100% lymphocytes), RBC: 65, protein: 100, glucose: 120 (unit not given). | Rare neurological manifestation. CSF:  SARS-CoV-2 not tested. |
| Gutiérrez-Ortiz et al.5  April 2020b | Case report | 2 | Confirmed by RT-PCR on oropharyngeal swab | Yes |  |  |  |  | 1 patient with Miller Fisher syndrome  1 patient with polyneuritis cranialis | Rare neurological manifestation. CSF:  SARS-CoV-2 negative (2/2) |
| Helms et al.6  April 2020b | Retrospective hospital-based single-center case series | 58 | Confirmed by RT-PCR on nasopharyngeal samples |  |  |  |  | Agitation: 40/58 (69.0)  Confusion: 26/40 (65.0) | Corticospinal tract signs: 39/58. Dysexecutive syndrome: 15/45.  Brain MRI: leptomeningeal enhancement: 8/13, perfusion abnormalities: 11/11, cerebral ischemic stroke: 3/13.  EEG: nonspecific changes: 8/8.  CSF: oligoclonal bands with the same pattern in serum: 2/7, elevated CSF IgG and CSF protein levels: 1/7 | Data of ARDS patients. CSF:  SARS-CoV-2 negative (7/7) |
| Huang et al.7  Feb 2020b | Retrospective hospital-based single-center case series | 41 | Confirmed by RT-PCR on lower respiratory tract specimens | Total: 3/38 (8.0)  ICU: 0/13  Non-ICU (counted as mild/moderate in table 1): 3/25 (12.0) |  |  |  |  |  | Data of ICU/non-ICU cases. Headache (total/ICU) excluded from table 1 due to overlap with Ref 1 (Chen et al.) and Ref 43 (Yang et al.) |
| Klopfenstein et al.8  April 2020b | Retrospective hospital-based single-center case series | 114 | Confirmed by RT-PCR on respiratory samples, mainly  nasopharyngeal swabs, sputum, bronchial aspirates, or bronchoalveolar lavage fluids | 44/54 (81.5) of anosmia patients |  | Anosmia: 54/114 (47.4) |  |  |  | Headache data excluded from table 1, as it describes the prevalence in anosmia patients. |
| Lechien et al.9  April 2020b | Prospective hospital-based multi-center case series | 417 | Confirmed by RT-PCR (not specified) |  |  | Total: 357/417 (85.6)  Anosmia: 284/417 (68.1)  Hyposmia: 73/417 (17.5), all mild/moderate | Total: 342/385 (88.8), all mild/moderate |  |  | Data of mild to moderate cases. |
| Liu et al.10  Feb 2020b | Retrospective hospital-based multi-center case series | 137 | Confirmed by RT-PCR on sputum and nasopharyngeal swabs | 13/137 (9.5) |  |  |  |  |  |  |
| Lu et al.11  April 2020b | Retrospective hospital-based multi-center case series | 304 | Chinese guideline (6th edition) |  |  |  |  |  | Neither acute symptomatic seizures nor status epilepticus were observed. | Evidence suggesting no additional risk of acute symptomatic seizures in people with COVID-19. |
| Mao et al.12  April 2020b | Retrospective hospital-based multi-center case series | 214 | WHO interim guideline/confirmed by RT-PCR on throat swab | Total: 28/214 (13.1)  Severe: 15/88 (17.0)  Non-severe: 13/126 (10.3) | Total: 36/214 (16.8)  Severe: 17/88 (19.3)  Non-severe: 19/126 (15.1) | Total: 11/214 (5.1)  Severe: 3/88 (3.4)  Non-severe: 8/126 (6.3) | Total: 12/214 (5.6)  Severe: 3/88 (3.4)  Non-severe: 9/126 (7.1) | Total: 16/214 (7.5)  Severe: 13/88 (14.8)  Non-severe: 3/126 (2.4) | Acute cerebrovascular disease: 6/214 (2.8), 5 severe cases. Vision impairment: 3/214 (1.4), 2 severe cases. Nerve pain: 5/214 (2.3), 4 severe cases. Skeletal muscle injury: 23/214 (10.7), 17 severe cases. | Data separated by severe and non-severe cases. |
| Moein et al.13  April 2020b | Hospital-based single-center case-control study | 60 patients and 60 age-, sex-matched controls | Confirmed by RT-PCR on nasopharyngeal wash/aspirate or nasal aspirate. |  |  | Anosmia: 59/60 (98.3) | Ageusia: 14/60 (23.3) |  |  |  |
| Moriguchi et al.14  March 2020b | Case report | 1 | Confirmed by RT-PCR using CSF (not detected in the nasopharyngeal swab) | Yes |  |  |  | Loss of consciousness | Meningitis/encephalitis presented with generalized seizure. MRI: right lateral ventriculitis and encephalitis mainly on right mesial temporal lobe and hippocampus. CSF:12 cells/µl (mostly mononuclear). RT-PCR test for SARS-CoV-2 was positive twice. | Rare neurological manifestation. CSF:  SARS-CoV-2 positive. |
| Qin et al.15 March 2020b | Retrospective hospital-based single-center case series | 452 | WHO interim guideline/confirmed by RT-PCR on nasal and pharyngeal swab | Total: 52/452 (11.5)  Severe: 39/286 (13.6)  Non-severe: 13/166 (7.8) |  |  |  |  |  | Data separated by severe and non-severe cases. |
| Tian et al.16 Feb 2020b | Retrospective hospital-based multi-center case series | 262 | Chinese guideline (5th edition)/confirmed by RT-PCR on respiratory specimens | Total: 17/262 (6.5)  Severe: 3/46 (6.5)  Non-severe: 14/216 (6.5) |  |  |  |  |  | Data separated by severe and non-severe cases. |
| Yan et al. 17  April 2020b | Internet-based single-institution cross-sectional study | 59 (and 203 patients with influenza-like symptoms) | PCR-confirmed testing for COVID-19 (not specified) | 39/59 (66.1),  Patients with influenza-like symptoms: 99/203 (48.8) |  | 40/59 (67.8)  Patients with influenza-like symptoms: 33/203 (16.3) | 42/59 (71.2)  Patients with influenza-like symptoms: 35/203 (17.2) |  |  | Data of patients with influenza-like symptoms but negative COVID-19 test. |
| Ye et al. 18  April 2020b | Case report | 1 | Positive for SARS-CoV-2 (not specified) |  |  |  |  | Yes | Encephalitis with meningeal irritation signs (including nuchal rigidity, Kernig sign, and Brudzinski sign). CSF normal. RT-PCR in CSF test for SARS-CoV-2 negative. Head CT normal. | Rare neurological manifestation.  CSF: SARS-CoV-2 negative. |
| Zhang et al. 19  April 2020b | Retrospective hospital-based single-center cohort study | 663 | WHO interim guideline and Chinese guideline (rev. 5th edition)/confirmed by RT-PCR on both nasal and pharyngeal swabs | Total: 20/663 (3.0)  Mild/moderate: 7/254  Severe: 11/315  Critical: 2/94  Survivors: 20/638  Non-survivors: 3/25 | Total: 23/663 (3.5)  Mild/moderate: 2/254  Severe: 15/315  Critical: 6/94  Survivors: 22/638  Non-survivors: 1/25 |  |  | Total: 10/663 (1.5)  Mild/moderate: 1/254  Severe: 0/315  Critical: 9/94  Survivors: 7/638  Non-survivors: 3/25 |  | Data separated by mild/moderate, severe and critical cases, and survivors and non-survivors. |
| Zhao et al. 20  April 2020b | Case report | 1 | Confirmed by RT-PCR on oropharyngeal swab |  |  |  |  |  | Guillain-Barré syndrome | Rare neurological manifestation. Most probably secondary infection with SARS-CoV-2 |
| Chen et al.21  Feb 2020c | Retrospective hospital-based single-center case series | 143 | Chinese guideline (5th edition)/ confirmed by RT-PCR on pharyngeal swab | Total: 28/143 (19.6)  Moderate: 18/107 (16.8)  Severe: 8/24 (33.3)  Critical: 2/12 (16.7) |  |  |  |  |  | Data separated by moderate, severe and critical cases. |
| COVID-19 National Incident Room Surveillance Team22  April 2020c | Retrospective nationwide case series | 6606 | Not provided | 2134/5863 (36.4) |  |  |  |  |  |  |
| Dai et al.23  March 2020c | Retrospective province-wide case series | 918 | Chinese guideline ( 5th edition) | 110/918 (12.0) |  |  |  |  |  |  |
| Fang et al.24  Feb 2020c | Retrospective hospital-based single-center case series | 79 | Chinese guideline ( 6th edition)/confirmed by RT-PCR on sputum, nasopharyngeal swabs, or lower respiratory tract specimens | Total: 6/79 (7.6)  Moderate: 2/55 (3.6)  Severe/critical: 4/24 (16.7)   * No separate date for headache and dizziness | |  |  |  |  | Data separated by moderate and severe/critical cases. |
| Han et al.25 Feb 2020c | Retrospective hospital-based single-center case series | 108 | Chinese guideline ( 5th edition)/confirmed by RT-PCR (not specified) | 14/108 (13.0), all mild |  |  |  |  |  | Data of mild cases. |
| He et al.26  March 2020c | Case report | 1 | confirmed by RT-PCR on pharyngeal swab |  |  |  |  |  | Cerebral infarction presented with hypoxic-ischemic encephalopathy, cerebral infarction and subarachnoid hemorrhage after one month treatment of COVID-19. The patient died 2 days after the cerebrovascular event. | Rare neurological manifestation. |
| Li et al 27  March 2020c | Retrospective hospital-based single-center case series | 221 | WHO interim guideline/confirmed by RT-PCR on throat swab |  |  |  |  |  | Acute ischemic stroke: 11/221. Cerebral venous sinus thrombosis: 1/221. Cerebral haemorrhage: 1/221 | Rare neurological manifestation. |
| Liu et al.28  Feb 2020c | Retrospective hospital-based single-center case series | 61 | Chinese guideline ( 4th edition)/confirmed by RT-PCR on throat swab | Total: 21/61 (34.4)  Moderate: 18/44 (40.9)  Severe/critical: 3/17 (17.6) |  |  |  |  |  | Data separated by moderate and severe/critical cases. |
| 刘茜 et al. 29  March 2020c | Autopsy study | 1 | Positive for SARS-CoV-2 (not specified) |  |  |  |  |  | Admitted with a diagnosis of multiple cerebral infarction. | Autopsy showed brain edema by gross examination without histopathology. |
| Lu et al.30  Feb 2020c | Retrospective hospital-based single-center case series | 75 confirmed patients (and 124 patients with SARS-CoV-2 RT-PCR negative) | Chinese guideline ( 6th edition)/ confirmed by RT-PCR on nasal and pharyngeal swabs | 6/75 (8.8);  Patients SARS-CoV-2 RT-PCR negative: 3/124 (3.4) |  |  |  |  |  |  |
| Qiu et al.31 March 2020c | Retrospective hospital-based multi-center case series | 36 | Chinese guideline ( 5th edition)confirmed by RT-PCR on upper nasopharyngeal swabs | Total: 3/36 (8.3)  Mild: 1/17 (5.9)  Moderate: 2/19 (10.5) |  |  |  |  |  | Data of children (0-16 years), separated by mild and moderate cases. |
| Shi et al.32  Feb 2020c | Retrospective hospital-based multi-center case series | 81 | WHO interim guideline/confirmed by RT-PCR on throat swab | 5/81 (6.2) | 2/81 (2.5) |  |  |  |  | Headache (total) excluded from table 1, due to overlap with Ref 1 (Chen et al.) and Ref 12 (Mao et al.). |
| Spiteri et al.33  March 2020c | Retrospective multi-country case series | 38 | confirmed by two separate SARS-CoV-2 RT-PCR tests | 6/38 (15.8) |  |  |  |  |  |  |
| Sun et al.34  April 2020c | Retrospective hospital-based multi-center case series | 150 | Chinese guideline (rev. 5th edition)/confirmed by RT-PCR on sputum, nasopharyngeal swabs or lower respiratory tract specimens | 3/150 (2.0) |  |  |  |  |  |  |
| Wang et al.35  March 2020c | Case report | 1 | Diagnosed according to Clinical and CT imaging features. RT-PCR on nasopharyngeal swab was negative for three times | Headache after recovery from the transient loss of consciousness. |  |  |  | Loss of consciousness for several minutes on day 7 after the initial symptom of sore throat; Fell into a stupor 20 days later; Dead after another 8 days. | Tuberculous meningitis presented with meningeal  irritation sign of nuchal rigidity; presence of bilateral Babinski signs; CSF: SARS-CoV-2 negative, gene X-pert mycobacterium tuberculosis positive; Head CT: low-density lesions in bilateral basal ganglia, bilateral semi-oval center and the left frontotemporal lobe | Rare neurological manifestation. CSF: SARS-CoV-2 negative. |
| Wei et al.36 Feb 2020c | Case report | 1 | Confirmed by RT-PCR on throat swab |  |  |  |  |  | Oculomotor nerve palsy presented with persistent diplopia and a droopy left eyelid; limb weakness  and poor spirit. MRI: no new infarction, bleeding of brainstem or pituitary apoplexy, tumor and MS. MRA: no aneurysms. No indication for underlying structural cause of oculomotor nerve injury | Rare neurological manifestation. CSF: SARS-CoV-2 not tested. |
| Wen et al.37  Feb 2020c | Retrospective hospital-based single-center case series | 46 | Chinese guideline (5th edition)/confirmed by RT-PCR on nasal or pharyngeal swabs | 15/46 （32.6）- no separate data for headache and dizziness | |  |  |  |  |  |
| Wu et al.38  Feb 2020c | Retrospective hospital-based multi-center case series | 80 | WHO interim guideline/confirmed by RT-PCR on throat swab and/or nose swab | 13/80 (16.3) |  |  |  |  |  |  |
| Wu et al.39 March 2020c | Retrospective hospital-based multi-center case series | 74 | WHO interim guideline/confirmed by RT-PCR on nasopharynx swab | 2/74 (2.7) |  |  |  |  |  | Data of children (0-16 years) |
| Xiang et al.40  March 2020c | Case report | 1 | Confirmed by RT-PCR on CSF (RT-PCR on respiratory specimens not provided) |  | Dizziness as one of the initial symptoms. |  |  | Agitation (and ARDS) on the 10th day, admitted to ICU. Consciousness recovered on day 32. | Viral encephalitis as clinical diagnosis. Generalized seizure developed on day 14; Meningeal irritation sign of nuchal rigidity; presence of bilateral Babinski signs; head CT normal; CSF: SARS-CoV-2 positive, genome was registered in GISAID database (ICDC-DT005). | Rare neurological manifestation. CSF: SARS-CoV-2 positive. |
| Xiang et al.41  March 2020c | Retrospective hospital-based single-center case series | 49 | Chinese guideline (4th edition)/confirmed by RT-PCR on respiratory or blood samples | Total: 6/49 (12.2)  Moderate: 4/40 (10.0)  Severe/critical: 2/9 (22.2) – no separate data for headache and dizziness | |  |  |  |  | Data separated by moderate and severe/critical cases. |
| Xu et al.42 April 2020c | Retrospective hospital-based multi-center case series | 32 | WHO interim guideline/confirmed by RT-PCR on throat swab | 2/21 (10.0) |  |  |  |  |  | Data of children (<18 years) |
| Yang et al.43  Feb 2020c | Retrospective hospital-based single-center case series | 52 | WHO interim guideline, not further specified | Critical: 3/52 (5.8)  Survivors: 1/20 (5.0)  Non-survivors: 2/32 (6.3) |  |  |  |  |  | Data of severe cases, separated by survivors and non-survivors. |
| Yuan et al.44  March 2020c | Retrospective citywide case series | 223 | Chinese guideline ( 6th edition)/confirmed by RT-PCR (samples not specified) | Total: 11/223 (4.9)  Mild/moderate: 10/192 (5.2)  Severe/critical: 1/31 (3.2) |  |  |  |  |  | Data separated by mild/moderate and severe/critical cases. |
| Ai et al.45  Feb 2020d | Retrospective hospital-based single-center case series | 102 | Chinese guideline (5th edition)/confirmed by RT-PCR on throat swab |  | 4/102 (3.9) |  |  |  |  |  |
| Cao et al.46  March 2020d | Retrospective citywide case series | 198 | Chinese guideline (5th edition)/confirmed by RT-PCR on throat swab | Total: 24/198 (12.1)  ICU: 0/19  Non-ICU: 24/179 (13.4), no separate data for headache and dizziness | |  |  |  |  | Data of ICU and non-ICU cases. |
| Chen et al.47  March 2020d | Retrospective hospital-based single-center case series | 101 | Chinese guideline (5th edition)/ 56.4% were confirmed by RT-PCR | 3/101 (3.0) | 7/101 (6.9) |  |  |  |  | Data of non-survivors. |
| Chen et al.48  March 2020d | Retrospective hospital-based multi-center case series | 534 | Chinese guideline (7th edition)/confirmed by RT-PCR on nasopharyngeal swabs | Mobile cabin hospital: 45/263 (17.1)  Tongji Hospital: 76/271 (28.0) |  |  |  |  |  | Headache (Tongji Hospital) excluded from calculations in table 1 due to overlap with Ref 15 (Qin et al.). |
| Chen et al.49 March 2020d | Retrospective hospital-based single-center case series | 123 | Chinese guideline (6th edition)/confirmed by RT-PCR on throat swab | Total: 21/123 (17.1)  With HBV: 2/15 (13.3)  Without HBV: 19/108 (17.6) |  |  |  |  |  | Data of patients with and without HBV. |
| Chen et al.50  March 2020d | Retrospective hospital-based multi-center case series | 291 | Chinese guideline (not specified)/confirmed by RT-PCR on throat swab | Total: 20/291 (6.9)  Mild: 2/29 (6.9)  Moderate: 13/212 (6.1)  Severe/critical: 5/50(10.0) | Total: 12/291 (4.1)  Mild: 1/29 (3.4)  Moderate: 10/212 (4.7)  Severe/critical: 1/50(2.0) |  |  |  |  | Data separated by mild, moderate and severe/critical cases. Headache (total) excluded from calculations in table 1 due to overlap with Ref 23 (Dai et al.). |
| Chen et al.51 April 2020d | Retrospective hospital-based single-center case series | 284 | Chinese guideline (7th edition)/confirmed by RT-PCR on respiratory tract  samples | 32/284 (12.1) |  |  |  |  |  |  |
| Cummings et al.52 April 2020d | Retrospective hospital-based multi-center case series | 257 | Confirmed by RT-PCR on naso- and/or oro-pharyngeal swab | 10/257 (3.9), all critical cases |  |  |  |  |  | Data of critical cases. |
| Fan et al.53 March 2020d | Retrospective hospital-based single-center case series | 55 | Chinese guideline (5th edition) | Total: 2/55 (3.6)  Mild/moderate: 2/47 (4.3)  Severe/critical: 0/8 |  |  |  |  |  | Data separated by mild/moderate and severe/critical cases. |
| Feng et al.54  Feb 2020d | Retrospective hospital-based multi-center case series | 141 | WHO interim guideline/confirmed by RT-PCR on nasal and pharyngeal swab | Total: 5/141 (3.5)  Stable: 4/126 (3.2)  Progressive: 1/15 (6.7),  all moderate |  |  |  |  |  | Data of moderate cases. Headache (total) excluded from table 1 due to overlap with Ref 23 (Dai et al.). |
| Fu et al.55 March 2020d | Retrospective hospital-based single-center case series | 36 | Chinese guideline (5th edition)/confirmed by RT-PCR on respiratory or blood samples | 2/36 (5.6) |  |  |  |  |  |  |
| Guan et al.56  Feb 2020d | Retrospective hospital-based multi-center case series | 1590 | WHO interim guideline/confirmed by RT-PCR on nasal and pharyngeal  swab | 205/1328 (15.4) |  |  |  | 20/1421 (1.4) |  |  |
| Guan et al.57  Feb 2020d | Retrospective hospital-based multi-center case series | 1099 | WHO interim guideline/confirmed by RT-PCR on nasal and pharyngeal swab specimens | Total: 150/1099 (13.6)  Non-severe: 124/926 (13.4)  Severe: 26/173 (15.0) |  |  |  |  |  | Data of severe and non-severe cases available. Headache (total) excluded from table 1 due to overlap with Ref 56 (Guan et al.). |
| Guo et al.58 April 2020d | Retrospective hospital-based multi-center case series | 159 | Chinese guideline (not specified) | 3/118 (2.5) |  |  |  |  |  | Data of non-survivors. |
| Hu et al.59  March 2020d | Retrospective hospital-based single-center case series | 323 | WHO interim guideline and Chinese guideline (5th edition)/confirmed by RT-PCR on throat swab | Total: 3/323 (0.9)  Moderate: 3/151 (2.0)  Severe: 0/146  Critical: 0/26 |  |  |  |  |  | Data separated by moderate, severe and critical cases. |
| Huang et al.60 March 2020d | Retrospective hospital-based single-center case series | 125 | Chinese guideline (6th edition) | Total: 24/125 (19.2)  Mild: 16/93 (17.2)  Severe: 8/32 (25.0) |  |  |  |  |  | Data separated by mild and severe cases. Headache (total) excluded from table 1 due to overlap with Ref 51 (Chen et al.). |
| Huang et al.61 March 2020d | Retrospective hospital-based single-center case series | 36 | Confirmed by RT-PCR (not specified) |  |  |  |  | 8/36 (22.2) |  | Data of non-survivors. |
| Jiang et al.62 April 2020d | Retrospective hospital-based single-center case series | 55 | WHO interim guideline and Chinese guideline (7th edition)/confirmed by RT-PCR on throat swab | Total: 10/55 (18.2)  Non-severe: 8/47 (17.0)  Severe: 2/8 (25.0) |  |  |  |  |  | Data separated by severe and non-severe cases. Headache (total) excluded from table 1 due to overlap with Ref 38 (Wu et al.). |
| Kluytmans-van den Bergh et al.63 March 2020d | Retrospective hospital-based multi-center case series | 86 | Confirmed by RT-PCR on oropharyngeal samples | 49/86 (57.0) |  |  | 6/86 (7.0) |  |  | Data of healthcare workers. |
| Lei et al.64  March 2020d | Retrospective hospital-based single-center case series | 67 | Confirmed by RT-PCR on nasal and pharyngeal swabs or blood samples | 9/67 (13.4), no separate data for headache and dizziness | |  |  |  |  |  |
| Leung et al.65 April 2020d | Retrospective hospital-based multi-center case series | 50 | Confirmed by RT-PCR on sputum specimens and throat swabs pooled with nasopharyngeal aspirates |  |  |  |  | Confusion: 1/50 (2.0) |  |  |
| Levinson et al.66 April 2020d | Retrospective hospital-based single-center case series | 45 | Confirmed by RT-PCR on naso-pharyngeal swabs | 20/42 (47.6), all mild | 9/42 (21.4), all mild | Anosmia: 15/42 (35.7), all mild | 14/42 (33.3), all mild |  |  | Data of mild cases. |
| Li et al.67  Feb 2020d | Retrospective hospital-based single-center case series | 47 | Chinese guideline (5th edition)/confirmed by RT-PCR on throat swab | 3/47 (6.4), all severe |  |  |  |  |  | Data of severe cases. |
| Liu et al.68  Feb 2020d | Retrospective hospital-based single-center case series | 51 | WHO interim guideline and Chinese guideline (5th edition) | Total: 5/51 (9.8)  Moderate: 5/44 (11.4)  Severe/critical: 0/7 | Total: 7/51 (13.7)  Moderate: 5/44 (11.4)  Severe/critical: 2/7 (28.6) |  |  |  |  | Data separated by moderate and severe/critical cases. |
| Liu et al.69  March 2020d | Retrospective hospital-based single-center case series | 153 | Confirmed by RT-PCR on pharyngeal swab | 12/153 (7.8) | 4/153 (2.6) |  |  |  |  |  |
| Liu et al.70  March 2020d | Retrospective hospital-based single-center case series | 41 | WHO interim guideline and Chinese guideline (5th edition)/confirmed by RT-PCR on throat swab | Total: 2/41 (4.9)  With CVM: 2/24 (8.3)  Without CVM: 0/17 | Total: 5/41 (12.2)  With CVM:2/24 (8.3)  Without CVM: 3/17 (17.6) |  |  |  |  | Data of healthcare workers, separated by patients with and without CVM. |
| Lu et al.71  Feb 2020d | Retrospective citywide case series | 265 | WHO interim guideline and Chinese guideline (5th edition)/confirmed by RT-PCR on nasopharyngeal swab | Total: 26/265 (9.8)  Mild/moderate: 25/243 (10.3)  Severe/critical: 1/22 (4.5) |  |  |  |  |  | Data separated by mild/moderate and severe/critical cases. Headache (total) excluded from table 1 due to overlap with Ref 87 (Zeng et al.). |
| Nie et al.72  March 2020d | Retrospective hospital-based single-center case series | 97 | Chinese guideline (5th edition)/confirmed by RT-PCR on nasopharyngeal and anal swab samples | Total: 7/97 (7.2)  Mild: 5/72 (6.9)  Severe: 2/25 (8.0), no separate data for headache and dizziness | |  |  |  |  | Data separated by mild and severe cases. |
| Pilotto et al.73 April 2020d | Case report | 1 | Confirmed by RT-PCR on nasopharyngeal swab |  |  |  |  | Severe alterations of consciousness; progressive irritability, confusion and asthenia. | Steroid-responsive severe encephalopathy presented as akinetic mutism with a wakeful state of profound apathy. Brain CT: unremarkable. Brain MRI with gadolinium: no significant alterations. EEG: generalized slowing. CSF: HSV-1, HSV-2, HSV-6, HSV-8, EBV, VZV, Adenovirus, SARS-CoV-2 negative; mild lymphocytic pleocytosis (18/uL), moderate CSF protein (696 mg/dl); no oligoclonal bands. No sign of immune-mediated encephalitis (NMDAR, LGI1, CASPR2, GABAAR, GABABR and AMPAR, Ri, Yo, Ma2, Hu, Amphiphysin negative), anti-MOG antibodies negative | Rare neurological manifestation. CSF: SARS-CoV-2 negative. |
| Poyiadji et al.74  March 2020d | Case report | 1 | Confirmed by RT-PCR on nasopharyngeal swab |  |  |  |  |  | Acute hemorrhagic necrotizing encephalopathy with a 3-day history of cough, fever, and altered mental status. MRI: hemorrhagic rim enhancing lesions within the bilateral thalami, medial temporal lobes, and subinsular regions. SARS-CoV-2-PCR in blood positive. HSV-1/2 and VZV-PCR in CSF neg. Further CSF analysis was not performed. | Rare neurological manifestation. No CSF data available. |
| Qi et al.75  March 2020d | Retrospective hospital-based multi-center case series | 267 | WHO interim guideline and severity categorized by American Thoracic Society guideline/confirmed by RT-PCR on nasopharyngeal swab and bronchoalveolar lavage fluid, or anal swab |  |  |  |  | Confusion: Total: 25/267 (9.4)  Non-severe: 15/217 (6.9)  Severe: 10/50 (20) |  | Data separated by severe and non-severe cases. |
| Shi et al.76  April 2020d | Retrospective hospital-based single-center case series | 101 | WHO interim guideline/confirmation method not specified | 5/101 (5.0) |  |  |  |  |  | Data of non-survivors. |
| Tabata et al.77  April 2020d | Retrospective hospital-based single-center case series | 104 | Confirmed by RT-PCR on the pharyngeal swab or sputum | 10/104 (9.6) |  |  |  |  |  |  |
| Tian et al.78  March 2020d | Retrospective hospital-based single-center case series | 37 | Chinese guideline (5th and 6th edition)/confirmed by RT-PCR on nasal and pharyngeal swabs | 3/37 (8.1) |  |  |  |  |  |  |
| Wang et al.79 April 2020d | Retrospective hospital-based single-center case series | 45 | Chinese guideline (6th edition)/confirmed by RT-PCR | Total: 4/45 (8.9)  Moderate: 4/35 (11.4)  Severe: 0/10 |  |  |  |  |  | Data separated by moderate and severe cases. |
| Wen et al.80  March 2020d | Retrospective citywide case series | 417 | WHO interim guideline and Chinese guideline (6th edition)/confirmed by RT-PCR on sputum, blood, broncho-alveolar lavage fluid, naso- or oro-pharyngeal swab | Total: 55/417 (13.2)  Mild/moderate: 52/381 (13.6)  Severe/critical: 3/36 (8.3) |  |  |  |  |  | Data separated by mild/moderate and severe/critical cases. |
| Xi et al.81  March 2020d | Retrospective hospital-based single-center case series | 788 | WHO interim guideline/confirmed by RT-PCR on throat swab and sputum | 66/722 (8.4) |  |  |  |  |  |  |
| Xu et al.82  Feb 2020d | Retrospective citywide case series | 434 | Confirmed patients without specific definition | 39/434 (9.0) |  |  |  |  |  |  |
| Xu et al.83  March 2020d | Retrospective hospital-based multi-center case series | 69 | WHO interim guideline/confirmed by RT-PCR on pharyngeal swab | Total: 23/69 (33.3)  Mild: 18/44 (40.9)  Severe/critical: 5/25 (20.0) |  |  |  |  |  | Data of patients without comorbidities, data separated by mild and severe/critical cases. |
| Yan et al.84  March 2020d | Retrospective hospital-based single-center case series | 168 | WHO interim guideline and Chinese guideline (3rd edition)/confirmed by RT-PCR on sputum and throat swab | Total: 14/168 (8.3)  Non-severe: 9/132 (6.8)  Severe: 5/36 (13.9) | Total: 12/168 (7.1)  Non-severe: 8/132 (6.1)  Severe: 4/36 (11.1) |  |  |  |  | Data separated by severe and non-severe cases. |
| Yang et al.85 April 2020d | Retrospective hospital-based single-center case-control study | 126 confirmed patients with hypertension, 125 non-hypertension | Chinese guideline (5th edition)/confirmed method not specified | Hypertension: 20/126 (15.9)  Non-hypertension: 15/125 (12.1) |  |  |  |  |  | Data of patients with and without hypertension. |
| Yang et al.86  March 2020d | Retrospective hospital-based single-center case series | 55 | Chinese guideline (6th edition)/confirmed by RT-PCR on respiratory sample | Total: 6/55 (10.9)  With pneumonia: 2/21 (9.5)  Without pneumonia: 4/34 (11.8) | Total: 9/55 (16.4)  With pneumonia: 6/ 21 (28.6)  Without pneumonia: 3/34 (8.8) |  |  |  |  | Data of patients with and without pneumonia. |
| Zeng et al.87  March 2020d | Retrospective hospital-based multi-center case series | 752 | Confirmed by RT-PCR on pharyngeal swab | Shanghai: 33/338 (9.8)  Bejing: 46/414 (11.1) |  |  |  |  |  |  |
| Zhang et al.88  Feb 2020d | Retrospective hospital-based single-center case series | 82 | Confirmed by RT-PCR on nasal and pharyngeal swab |  |  |  |  | 17/82 (20.7) |  | Data of non-survivors. |
| Zhang et al.89  March 2020d | Retrospective hospital-based single-center case series | 221 | WHO interim guideline/confirmed by RT-PCR on pharyngeal swab | Total: 17/221 (7.7)  Non-severe: 13/166 (7.8)  Severe: 4/55 (7.3) |  |  |  |  |  | Data separated by severe and non-severe cases. |
| Zhao et al.90  April 2020d | Case report | 1 | Confirmed by RT-PCR on nasopharyngeal swab |  |  |  |  |  | Acute myelitis presented with weakness of both lower limbs with urinary and bowel incontinence, culminating in flaccid lower extremity paralysis. CSF and MRI analysis were not performed. | Rare neurological manifestation. CSF: SARS-CoV-2 not tested. |
| Zhao et al.91  March 2020d | Retrospective hospital-based single-center case series | 77 | WHO interim guideline/confirmed by RT-PCR on nasopharyngeal swab | Total: 10/77 (13)  Non-severe: 10/57 (17.5)  Severe: 0/20, no separate data for headache and dizziness | |  |  |  |  | Data separated by severe and non-severe cases. |
| Zheng et al.92 April 2020d | Retrospective hospital-based single-center case series | 34 | WHO interim guideline/confirmed by RT-PCR on respiratory specimen, | Total: 2/34 (5.9)  IMV: 2/15 (13.3)  NIV: 0/19 |  |  |  |  |  | Data of ICU cases. |

aData are n/N (%),where N is the total number of patients with available data. WHO interim guideline is the World Health Organization interim guidance for clinical management when COVID-19 is suspected (https://www.who.int/publications-detail/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-(ncov)-infection-is-suspected). Chinese guidelines are developed by the National Health Committee of the People's Republic of China (http://www.nhc.gov.cn/). Literature is reported in alphabetical order of first author, organized by pubmed retrievals (b), other sources (c) and preprints (d).

Abbreviations: CVM, cardiovascular manifestation; NIV, non-invasive ventilation; IMV, invasive mechanical ventilation

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