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Review

Impact of COVID -19 in cancer patients on severity of disease and fatal outcomes: A systematic review and meta-analysis



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ABSTRACT

Background and aimsbackground: Currently there is limited knowledge on cancer and COVID-19; we conducted a systematic review and meta-analysis to evaluate the impact of cancer on serious events including ICU admission rate and mortality in COVID 19.

Methods: PubMed, Cochrane Central Register of Clinical Trials were searched on April 16, 2020, to extract published articles that reported the outcomes of cancer in COVID-19 patients. The search terms were “coronavirus” and “clinical characteristics” with no language or time restrictions. We identified 512 published results and 13 studies were included in the analysis.

Results: There were 3775 patients, of whom 63 (1.66%) had a cancer. The pooled estimates of ICU admission in COVID 19 patients with and without cancer were 40% versus 8.42%.The odds ratio of ICU admission rates between the cancer and non-cancer groups was 2.88 with a 95% CI of 1.18 to 7.01 ($p = 0.026$). The pooled estimates of death rate in COVID -19 patients with and without cancer were 20.83% versus 7.82%. The odds ratio of death rates between the cancer and non-cancer groups was 2.25 with a 95% CI ranging from 0.71 to 7.10 with p value of 0.166. The pooled prevalence of cancer patients was 2% (95% CI 1–4).

Conclusions: Presence of cancer in COVID-19 leads to higher risk of developing serious events i.e. ICU admission, mechanical ventilation and mortality. The presence of cancer has a significant impact on mortality rate in COVID-19 patients.

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1. Introduction

Coronavirus disease 2019 (COVID-19) is new pandemic which has spread across the globe in late 2019 and early 2020 [1–3]. The massive outbreak of new corona virus (COVID-19) has first affected China followed by majority of countries in Asia, Europe, US, Australia and all continents [1–4]. There is exponential spread of virus leading to significant morbidity and mortality [1–5,17]. The

various symptoms associated with, the novel Corona virus are Fever, Cough, Dyspnea, Myalgia, and Fatigue [3–8]. Guan et al. has evaluated and performed the analysis of cases in China in identifying various clinical characteristics and their association with the severity of disease in COVID-19 patients [4]. Previous coexisting illness was seen in severe disease group in 39% patients as compared to 21% patients in non-severe disease group [5]. Various authors have analyzed the effect of associated comorbidity in COVID-19 infection and their impact on the overall outcomes [5–17]. Chronic underlying disease in patient with COVID-19 infection is having higher risk of morbidity and mortality [5–17]. The presence of underlying comorbidity is associated with risk of ventilator support and ICU care for the treatment of patients for

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Table 1
Sample size of selected studies and their characteristics.

	Country of Origin	Study type	Year of publication	Journal	Total no. of Patients	No of Cancer patients
Guan Wei-Jie (5)	China	Retrospective cohort	December-19	NEJM	1099	10
Nanshan Chen (6)	China	Retrospective cohort	January-20	Lancet	99	1
Chaolin Huang (7)	China	Retrospective cohort	January-20	Lancet	41	1
Kui Liu(8)	China	Retrospective cohort	January-20	Chinese Medical journal	137	2
Heshui Shi (9)	China	Retrospective cohort	February-20	Lancet	81	4
Xiaobo Yang (10)	China	Retrospective cohort	February-20	Lancet	52	2
Dawei Wang (11)	China	Retrospective cohort	February-20	JAMA	138	10
Chaomim Wu(12)	China	Retrospective cohort	March-20	JAMA	201	1
Fei Zhou (13)	China	Retrospective cohort	March-20	Lancet	191	2
Wanbo Zu (14)	China	Retrospective cohort	March-20	Journal of Medical Virology	32	2
Jian Wu(15)	China	Retrospective cohort	March-20	Clinical Infectious disease	80	1
Wenhua Liang (16)	China	Retrospective cohort	April-20	Lancet	1590	18
Shaoqing Lei (17)	China	Retrospective cohort	Apr-20	E Clinical Medicine	34	9

treatment of severe pneumonia [3,5–18]. Special attention needs to be given by the health care workers for patients with underlying chronic disease and optimal care must be provided [19]. Emami et al. performed a meta-analysis and analyzed the prevalence of various comorbidity associated with hospitalized COVID-19 patients [20]. They had evaluated only prevalence of these associated comorbidity and not analyzed their impact of severity of disease and treatment outcomes [20]. The overall immunity is low in cancer patient and are at high risk of systematic immunosuppression due to chemotherapy and radiation treatment leading to high chances of infection [18,19,21]. The cancer patients requires transportation to a cancer center for the treatment leading to high exposure risk to infection [18,22]. The awareness about impact of cancer in COVID-19 patients will help healthcare workers including medical oncologist, surgical oncologist, radiation oncologist and nursing staff to formulate proper guidelines for treatment [18,19,22,23]. Desai et al. had performed a meta-analysis and evaluated only pooled prevalence of cancer with hospitalized COVID-19 patients [23]. Despite this, the current knowledge is limited on whether there is impact of cancer on survival and requirement of intensive management in patients with COVID-19 infection [2–20,22,23]. Since several newer studies on corona infection have recently become available we aimed to study the effect of cancer on COVID-19 on important objectives.

We conducted a systematic review and meta-analysis to analyze the requirement of ICU admission, mortality rate in COVID-19 infection in cancer and non-cancer patients. We evaluated the clinical characteristics, laboratory parameters, chest imaging findings, prevalence of comorbidities, treatment and severe events in patients with COVID-19 infection.

2. Methods

2.1. Search strategy and selection criteria

For this systematic review and meta-analysis, we searched the literature on April 16, 2020, to identify published articles which reported the outcomes of COVID-19 patients with and without a cancer. We did a systematic literature search on PubMed, Cochrane Central Register of Clinical Trials on published articles which reported the outcomes of COVID-19 patients with and without a cancer in accordance with the PRISMA 2009 checklist criteria. The following search terms were used: “coronavirus” AND “clinical characteristics”.

We have used broad search words and not included cancer and corona as it reduced the number of retrieved articles. The search terms were kept broad so as to encompass all possibilities for applicable studies. Some records were also retrieved via cross-

references from published papers. There were no restrictions on the date of publication and language of articles published. After eliminating duplicates, two investigators (AAS and KN) independently reviewed all abstracts: the full texts of articles regarded as potentially eligible for consideration were extracted for further analysis. We searched the reference lists of relevant articles by hand to identify further articles for analysis. Thereafter articles were selected for final analysis according to predefined inclusion and exclusion criteria. Disagreements between the authors were resolved by consensus. All comparative articles which examined the clinical outcomes of COVID-19, with and without cancer, were included. We included only human studies and articles with clearly defined clinical outcome measures. The exclusion criteria included animal studies; absence of a comparison group; absence or unclear reporting of clinical outcome measures; isolated case reports or case series with sample size <5. Articles selected for final analysis were independently graded using the Newcastle–Ottawa Scale for the Assessment of the Quality of Nonrandomized Studies in Meta-analyses (Table 1) [5–17].

2.2. Data analysis

We reviewed the final articles to extract the following information from each: first author; year of publication; study design; study population characteristics for the COVID-19 with cancer and the non-cancer group; treatment regimen; outcome measures; study endpoints and conclusions. The specific outcome measures that were recorded for the meta-analysis included ICU admission and deaths rate in the cancer and non-cancer patient groups (Table 2).

The publication bias of the included studies for meta-analysis was calculated with funnel plot analysis. Funnel plots were analyzed by plotting the event rate against the inverse of the standard error. The funnel plots obtained were found to be symmetrical about the summary effect, with larger studies at the top and smaller studies at the A fixed-effects (weighted with inverse variance) or a random-effects model was used where appropriate, after computing the chi-squared and I statistics. When $p < 0.05$ or $I > 50\%$, the assumption of homogeneity was rejected and a random effects model was adopted. The mean pooled estimate of ICU admission, death rate was presented. Subsequently, comparisons between cancer and the non-cancer patient groups, in terms of death rate, ICU admission were made using the pooled estimates of odd's ratio (OR) (percentage and 95% CI). The level of significance was set at $p < 0.05$. All statistical analyses were performed using Stata version 12 (Stata Corp., College Station, Texas) and R Studio desktop v1.2.50 (RStudio, Inc, Boston).

Table 2
Summary of demographic data and outcomes of current meta-analysis.

Study	Total no. of Patients (n)	Male (%)	Female (%)	Median age of all patients (Years)	Healthcare workers affected (%)	Total Deaths (%)	Total ICU (%)	Cancer patients (n)	Non Cancer patients (n)	Cancer ICU (%)	Non Cancer ICU (%)	Cancer Death patient (%)	Non Cancer Death (%)
Guan Wei-Jie (5)	1099	58.1	41.9	47	3.5	15 (1.4)	56 (5.1)	10	1089	3 (30)	53 (4.86)	0	15 (1.4)
Nanshan	99	67.66	32.3	55.5 (Mean)	–	11 (11)	17 (17)	1	98	–	–	–	–
Chen (6)	41	73	27	49 (Mean)	–	6 (15)	13 (31.7)	1	40	0 (0)	13 (31.7)	0	6 (15)
ChaoLin	137	44	55.5	57	–	16 (11.7)	–	2	135	–	–	–	–
Huang (7)	81	52	48	49.5	–	–	–	4	77	–	–	–	–
Kui Liu (8)	52	67	33	59.7 (Mean) SD13.3	–	32 (61.5)	52 (100)	2	50	2 (100)	50 (100)	1 (50)	31 (62)
Heshui Shi (9)	138	54.3	45.7	56	29	6 (4.3)	36 (26)	10	128	4 (40)	32 (25)	–	–
Xiaobo Yang (10)	201	67.3	36.3	51	–	44 (21.9)	53 (26.4)	1	200	–	–	–	–
Dawei Wang (11)	191	62	38	56	–	54 (28)	50 (26)	2	189	–	–	0	54 (28)
Chaomim Wu (12)	32	47	53	46	–	–	–	2	30	–	–	–	–
Fei Zhou (13)	80	48.75	51.25	46.1±15.4 (Mean)	–	–	–	1	79	–	–	–	–
Wanbo Zu (14)	1590	–	–	48.7 years: Total patients 63.1 years: Cancer patients	–	–	–	18	1572	–	–	–	–
Jian Wu (15)	34	–	–	–	–	7 (20.5)	15 (44.1)	9	25	5 (55.5)	10 (40)	4 (44.4)	3 (12)
Wenhua Liang (16)													
Shaoqing Lei (17)													

2.3. Role of the funding source

There was no funding source for this study. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

4. Results

We identified 512 published papers and 13 studies were included in the analysis. These articles included a total of 3775 COVID-19 patients, 63 (1.66%) with Cancer and 3712 (98.3%) without cancer. From the initial search, a total of 502 articles were identified from PubMed, 10 from Cochrane database. This included 251 abstracts using the predefined inclusion and exclusion criteria. We excluded 261 articles on the basis of title and abstract review. Of the remaining 56 papers, 45 were excluded after full-text review. Two papers were excluded due to lack of comparative group. Four papers were included from hand search of reference lists.

We finally selected 13 articles for the meta-analysis (Fig. 1). The mean age of 1862 patients in five studies was 51.8 years (SD 3). The gender distribution in 12 studies showed that 58% were males, while females constituted 42% of the population (Table 2). In the cancer group (n = 63), 5 patients were of lung cancer and in 9 patients were treated with elective cancer surgery and 4 patients were of surgery performed or chemotherapy administered in last one month and no records were mentioned about other cancer patients. We reviewed the data from all 13 studies that were included in current meta-analysis with 3775 patients and evaluated symptoms, blood parameters, chest imaging findings and treatment in COVID-19 infections.

The evaluation of various symptoms of COVID-19 infection from 2105 patients of 11 studies the most common symptoms were fever (85.35%) followed by cough (68%), dyspnea (46%), myalgia (30%). Nausea/vomiting and diarrhea was seen in 6.6% and 6.2% patients respectively.

The evaluation of blood parameter of COVID-19 infection from 2151 patients of 11 studies showed the presence of Lymphocytopenia in 62.7%, leukopenia in 31%, leukocytosis in 22.85% and thrombocytopenia in 3.8% patients.

The evaluation of chest imaging of COVID-19 infection in 3165 patients from 12 studies showed that the most common chest imaging finding was bilateral pulmonary infiltrates (78%) followed by ground glass opacity (62.75%) and 24.5% patients had consolidation in chest radiograph.

The assessment of treatment from 1820 patients from 7 studies showed that all patients were treated with antibiotics and antiviral treatment. The treatment in 2151 patients with COVID-19 infection from 9 studies was with Oxygen therapy in 63%. Of 1855 patients from 8 studies, ICU care (34.5%) and mechanical ventilation (32%) was required. Invasive ventilation was required for 14.6% from 1654 patients in 7 studies. Extracorporeal membrane oxygenation (ECMO) was used for treatment of 3.5% cases of 1824 patients from 8 studies (Table 3).

3.1. Comparison of ICU admission between cancer and non-cancer group in the COVID-19 patients

The ICU admission rate from four studies of 30 patients with a Cancer patients were analyzed, giving a pooled estimate of mean rate of 40% (22.47 to 57.53).

The ICU admission rate from four studies of 1282 patients without a cancer were analyzed, giving a pooled estimate of mean rate of 8.42% (6.90 to 15.33).

The odds ratio of ICU admission rates between the cancer and non-cancer groups was 2.88 with a 95% CI ranging from 1.18 to

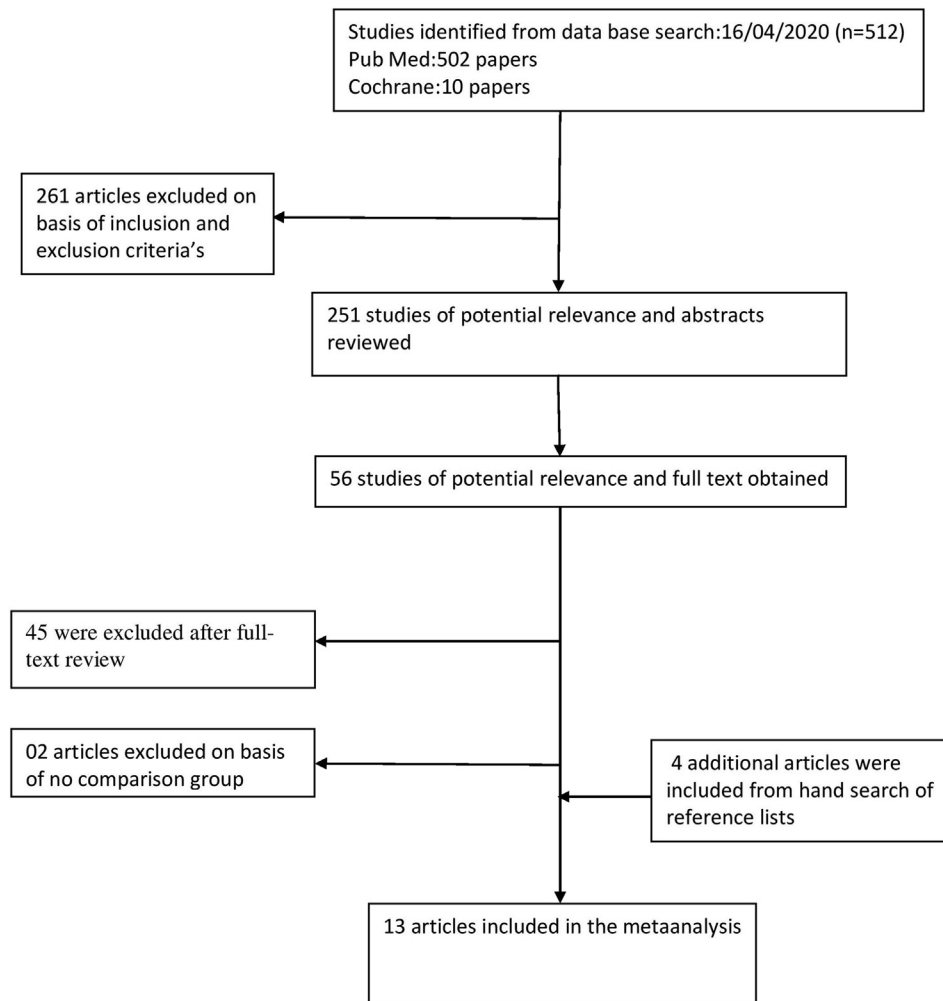


Fig. 1. Algorithm for database search and article selection.

Table 3
Summary of treatment modalities used in various selected studies.

Studies	Oxygen (%)	ECMO(%)	Mechanical ventilation (%)	ICU admission (%)	Invasive ventilation (%)
Guan Wei-Jie (5)	41.3	0.5	6.1	5	2.3
Nanshan Chen (6)	76	3	17	17	4
Chaolin Huang (7)	66	5	34	32	10
Kui Liu(8)	86.8	–	–	–	–
Heshui Shi (9)	–	–	–	–	–
Xiaobo Yang (10)	63.5	11.5	71	100	42
Dawei Wang (11)	76.8	2.9	23.2	26	12.3
Chaomim Wu(12)	82.1	0.5	33.3	26.4	–
Fei Zhou (13)	21	2	31	26	17
Wanbo Zu (14)	–	–	–	–	–
Jian Wu(15)	–	–	–	–	–
Wenhua Liang (16)	–	–	–	–	–
Shaoqing Lei (17)	5–5.9	2.9	45	44.1	14.7

7.01 with p value of 0.026. The results indicate a significant ICU requirement rates in Cancer patient group compared with non-cancer group. We did heterogeneity test on ICU stay between the four studies with results of $I^2 = 17\%$, $p = 0.30$ (Fig. 2).

3.2. Comparison of Death rates between Cancer and non-cancer group in the COVID-19 patients

The death rate from five studies of 24 patients with cancer were

analyzed, giving a pooled estimate of mean rate of 20.83% (12.96 to 28.71).

The death rate from five studies of 1393 patients with a without a cancer were analyzed, giving a pooled estimate of mean rate of 7.82% (6.41 to 9.24).

The odds ratio of death rates between the cancer and non-cancer groups was 2.25 with a 95% CI ranging from 0.71 to 7.10 with p value of 0.166. The results indicate a significant death rate in Cancer patient group compared with non-cancer group. We did

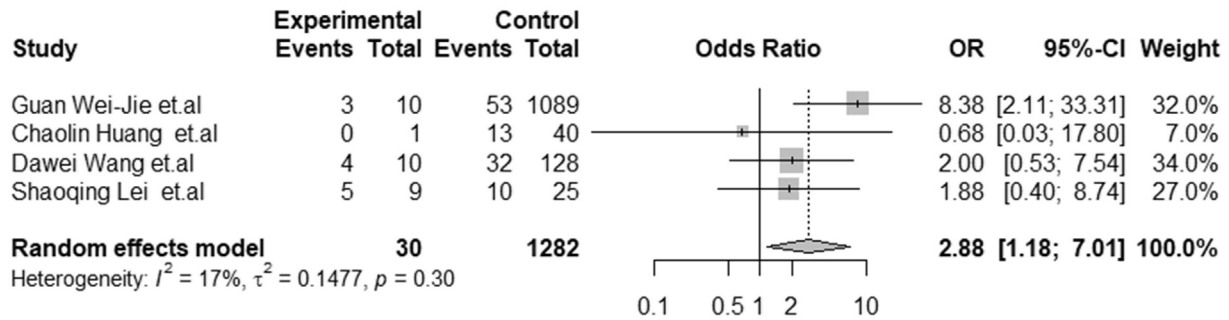


Fig. 2. Odds ratio with 95% confidence interval for ICU admission between cancer and non-cancer group in the COVID-19 patients.

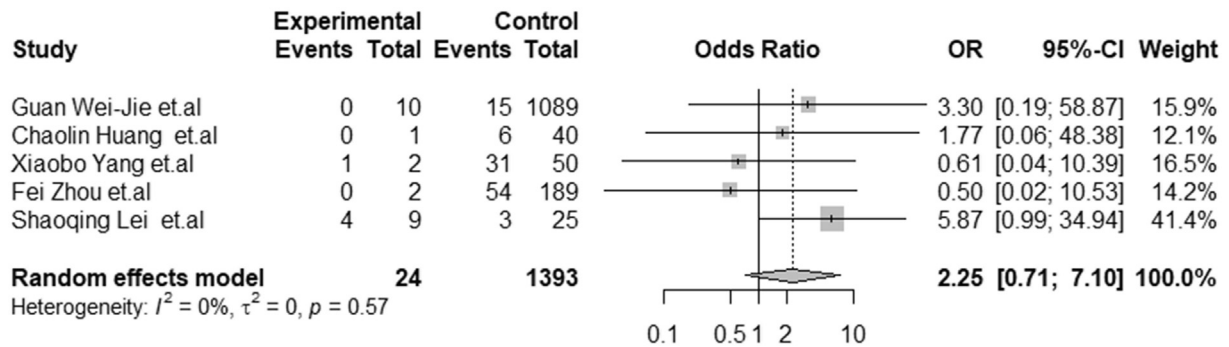


Fig. 3. Odds ratio with 95% confidence interval for death rate between cancer and non-cancer group in the COVID-19 patients.

heterogeneity test on death rates between the five studies with results of $I^2 = 0\%$, $p = 0.57$ (Fig. 3).

3.3. The prevalence of cancer in the COVID-19 patients

The pooled prevalence of cancer in COVID-19 infection from 13 studies with 3775 patients was 2% (95%CI, 1%–4%).

4. Discussion

To best of our knowledge, this would be a meta-analysis in which assessment was performed of studies which had a total of more than three thousand patients with report of prevalence and impact of cancer on serious events and mortality rate in COVID-19. In the current meta-analysis, we included 13 published studies with 3775 patients with a prevalence of cancer was 2% and observed that cancer had a major effect on patients with COVID 19 and leads to higher chances of serious events. The ICU admission rate for patients with a Cancer patients were of 40% as compared to patients without a cancer were analyzed, giving a pooled estimate of mean rate of 8.42%. The death rate of patients with cancer were of 20.83% as compared patients with a without a cancer were 7.82%. The presence of cancer has significant impact on death in COVID 19 patients.

The massive disease outbreak has placed heavy burden on health care system because of limited resources including personal protection equipment's, medications and ventilators [1,19,22]. The treatment of patients with various acute and chronic conditions i.e. trauma, cancer, heart diseases, kidney diseases etc. is compromised due to lock down in various countries [1,18,22]. The absence of immunity and lack of definitive medicines leads to higher risk of disease spread along the elderly population, immunocompromised patients and patients with various preexisting diseases [3,5–9,18]. In current study we also meta-analysis of patients with COVID -19

infection evaluated the prevalence of various preexisting comorbidities (Table 4). There is difficulty for patients to reach to the hospital and limited resources are made available for the treatment of various medical and surgical illness as compared to COVID-19 infection [17–19,21]. The treatment of cancer consists of multidisciplinary team that includes surgical oncologist, medical oncologist and radiotherapy. Cancer patients are more prone for COVID-19 infection as compared to normal population due to cancer immunosuppression, anticancer drugs that include chemotherapy and immunotherapy, radiotherapy treatment and surgical management [18–21]. The demographic data patients showed were the cancer patients were elderly as compared to total data population (63 years versus 48.7 years) [5]. The mean age of 1862 patients in five studies was 51.8 years (SD.3). The gender distribution in 12 studies showed that 58% were males, while females constituted 42% of the population.

Currently multiple studies on new disease have been published but still there is limited knowledge regarding cancer patients and COVID-19 infection on effect on survival, need for intensive care and association with severe events [5–21]. In patients with COVID-19 infection; severe events are a composite endpoint defined as the percentage of patients being admitted to the intensive care unit requiring invasive ventilation, or death. Guan Wei-Jie et al. reported severe events (composite endpoint) in 10% of Cancer patients as compared to 5.9% non-cancer [5]. Liang et al. showed that patients with cancer had higher incidence of severe events of 39% as compared to 8% in non-cancer patients and the difference was statistically significant [16]. Yu et al. found that cancer patients had an estimated 2-fold increased risk of COVID-19 than the general population [18]. Liang et al. reported that incidence of cancer in COVID-19 infections was higher as compared to the routine population registry (1% versus 0.29%) and Lung cancer accounted for 28% of COVID-19 infection patients [16]. After sub analysis of the patients with lung cancer the study found that 25% patients were in

Table 4
Summary of all comorbidities including cancer in COVID-19 patients.

Studies	Cancer patients	CKD	HTN	DM	Smoking	COPD	CVD	Comorbidity (HTN/DM/IHD/CKD/COPD) (%)
Guan Wei-Jie (5)	0.9	0.7	15	7.3	14.3	1	2.4	23.7
Nanshan Chen (6)	1	3	–	–	–	–	40	51
Chaolin Huang (7)	2	–	14.6	19.5	3	2	15	32
Kui Liu(8)	1.4	–	9.5	10	–	1.5	7.3	19.7
Heshui Shi (9)	4	4	15	12	–	11	10	26
Xiaobo Yang (10)	4	–	–	9	4	8	10	25
Dawei Wang (11)	7.2	2.8	31	10	–	2.8	14.4	46.4
Chaomim Wu(12)	0.5	1	19.4	10.9	–	2.5	4	46.3
Fei Zhou (13)	1	1	30	19	–	3	8	53
Wanbo Zu (14)	3	2	19	9	–	5	4	46.7
Jian Wu(15)	1.2	1.2	–	–	–	0	31	47
Wenhua Liang (16)	1.1	–	–	–	6.9	–	–	–
Shaoqing Lei (17)	26.4	2.9	38	23.5	–	2.9	5.9	58.8

whom surgical treatment or chemotherapy administration was done within last one month and 75% were patients in whom previous surgical resection was performed and were on follow-up [16].

Liang et al. evaluated comorbidities in cancer patients versus total data population and the results showed history of smoking (18% versus 7%) and severe CT scan findings (94% versus 71%) [5]. Yu et al. had reported that three major subtypes of cancer in their study were gastrointestinal (35.9%), thoracic (21%), and head and neck cancers (13%) [18]. Desai et al. in a meta-analysis of cancer in patients with COVID -19 infection showed that the overall pooled prevalence of cancer was 2.0% (95% CI, 2.0%–3.0%) [23]. Their results showed the prevalence in larger studies (>100 patients) was 3% as compared to other studies (<or = 100 patients) was 2% [23]. The results of current meta-analysis showed that prevalence of cancer in COVID-19 infection patient from 13 studies with 3775 patients was 2% (95%CI, 1%–4%).

The results of current study showed that the most common symptom were fever (85.35%) followed by cough (68%), dyspnea (46%), myalgia (30%). Nausea/vomiting and diarrhea was seen in 6.6% and 6.2% patients respectively. In evaluation of blood parameters 2151 patients of COVID-19 infection showed presence of Lymphocytopenia in 62.7%, leukopenia in 31%, leukocytosis in 22.85% and 3.8% had thrombocytopenia and most of the patients had elevated levels of C-reactive protein. The results of current study showed the most common chest imaging finding in were bilateral pulmonary infiltrates (78%) followed by ground glass opacity (62.75) and consolidation (24.5%). The results of current study showed that all patients were treated with antibiotics and antiviral treatment. The summary of the treatment consists of Oxygen therapy in 63%, ICU care in 34.5% and mechanical ventilation in 32% patients (Table 3). Invasive ventilation was required for 14.6% of the patients. Extracorporeal membrane oxygenation (ECMO) was used for treatment of 3.5% cases.

ICU care is a key factor in management of patients with COVID-19 infection. In study by Guan Wei et al.; patients with cancer and non cancer required ICU care in 30% and 4.8% respectively [5]. In study by Shaoqing Lei et al. of COVID-19 infections, comparison between ICU care required patients compared to non-ICU care patients with underlying comorbidities (Hypertension, Diabetes, Cancer) was 80% versus 42% [17]. The patient with cancer requirement of ICU care was in 55% compared to 40% in patients with non cancer [17]. The results of current meta-analysis showed that the requirement of ICU care in 30 cancer patients was 40% as compared to 1282 non cancer patients was 8.2% with the Odds ratio of 2.88 ($p = 0.026$). The requirement of ICU care was significant higher in cancer in COVID-19 infected patients.

The death rate reported by various studies ranges from 1.2% to 28% in patients with COVID-19 infection [5–17]. The death rates

were assessed in studies by Guan We-Wi et al. (10 cancer patients and 1089 non cancer), Cholin Huang et al. (1 cancer patients and 40 non cancer) and Fei Zhou et al. (2 cancer patients and 189 non cancer) [5,7,13]. The results of above studies showed that the death rate in cancer patients was much lower as compared to non-cancer patient (0% versus 5.6%) [5,7,13]. In study by Shaoqing Lei et al. of patients with COVID-19 infection treated with surgical treatment death rate was of 20.5% and the median duration from first symptom to death was 9 days [17]. The death rate among in COVID-19 with cancer was of 44.4% as compared to non-cancer was 12% [17]. The mean duration of surgery in cancer patients was 299 min and the surgeries performed were radical resection of rectal cancer, pancreatoduodenectomy, total esophagectomy and thoracoscopic lobectomy [17]. So the factors like higher surgical difficulty category may also attribute to higher death rate and COVID-19 infection may not be only cause of death in these patients. The results of current meta-analysis showed that the death rate in 24 cancer patients was 20% as compared to 1393 non cancer patients was 7.4% and the Odds ratio was 2.25 with $p = 0.016$. The death rate was significant higher in cancer in COVID-19 infected patients.

7. Limitations of this study

Inherent biases could exist, particularly in terms of patient selection, heterogeneous medical and surgical treatment regimes and loss to follow-up. The published studies lacked subset analysis and impact of surgical treatment or chemotherapy on survival, severe events and ICU admission. Due to low incidence of tumor, small sample size and lack of details of cancer subtypes in the published studies makes the data interpretation difficult. Also there is a bias in requirement of ICU care in surgically treated patients as the need of intensive care may be due to surgical procedure and not due to COVID-19 infection and vice a versa. Nevertheless, our assessment of the studies included in the analysis shows that the quality of the evidence has been reasonably good. The sample size is small due to rarity of cancer in patients with COVID-19 infection and this may predispose to error, owing to insufficient power. So by undertaking a meta-analysis we have attempted to overcome that limitation. Risk factors for poor prognosis of cancer patients treated with surgical modality, chemotherapy and radiotherapy treatment with COVID-19 needs a further study with larger sample size.

8. Conclusion

The COVID-19 infection in cancer patients is likely to result in severe and even fatal disease. The results of current meta-analysis suggest that cancer patients with COVID-19 infection have higher requirement of ICU care and higher mortality rates. Cancer is an

important comorbidity factor in COVID-19 infection making them more prone to complications. In future when the number of patients in the pandemic will reduce and a strategy of guidelines must be prepared for treatment with surgery, chemotherapy and radiotherapy for various cancer patients associated with corona infections. The multimodality treatment in cancer requires multiple hospital visits making them and their family members prone for infection with COVID-19. The cancer patients must be given safety guidelines to avoid visiting infected zones and any contact with possible infected person.

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Ethical permission

Not required as this analysis do not involve patients directly.

Declaration of competing interest

Nothing to declare.

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