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The death of Charlotte Brontë from hyperemesis gravidarum and refeeding syndrome:
A new perspective

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1 Short Communication

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3 **The death of Charlotte Brontë from hyperemesis gravidarum and refeeding syndrome:**
4 **A new perspective**

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44 **Abstract**

45 Many theories have been advanced concerning the cause of Charlotte Bronte's death, none of
46 which fully explain all the symptoms she experienced in the course of her final illness. Her
47 death certificate records the cause of death as phthisis (tuberculosis), but there is no evidence,
48 other than circumstantial, to support this diagnosis. A diagnosis of Addison's disease, caused
49 by tuberculosis of the adrenals, has been proposed, but this is unlikely, since it does not fit
50 well with two and a half months of severe anorexia, nausea and vomiting, followed by
51 remission of these symptoms and eventual death. We agree, as suggested by some authors,
52 that the most likely diagnosis was hyperemesis gravidarum, but suggest that this was
53 complicated by the refeeding syndrome consequent on recovery of her appetite after
54 resolution of hyperemesis gravidarum and that this was the cause of her death. These two
55 diagnoses are compatible with the remission in her symptoms of anorexia, nausea and
56 vomiting in the third week of March 1855, followed by further decline and death.

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59 Many theories have been advanced concerning the cause of Charlotte Bronte's death, none of
60 which fully explain all the symptoms she experienced in the course of her final illness as
61 described in a contemporary account [1] and in more recent publications. [2-6]

62 On June 29th 1854 she married Arthur Nicholls, her father's curate, and by all accounts,
63 including her own, it was a very happy relationship. In November of that year, following a
64 long walk in the rain, she developed a chill, which some have suggested, contributed to her
65 final illness, but this seems unlikely since she appears to have largely recovered from it by the
66 end of the year. Mrs. Gaskell, her contemporary biographer, records that, at the beginning of
67 January 1855, Charlotte "was attacked by new sensations of perpetual nausea and ever
68 recurring faintness". [1] A doctor "assigned a natural cause (i.e. pregnancy) for her miserable
69 indisposition" and said that it would soon pass. [1] Mrs. Gaskell then writes, "the dreadful
70 sickness increased and increased, till the very sight of food occasioned nausea". She records
71 one witness as saying, "a wren would have starved on what she ate during those last six
72 weeks". [1] From mid-January she suffered from nearly continuous vomiting and took to her
73 bed, too weak to sit up. Her biographer goes on to record, "*About the third week in March*
74 *there was a change; a low wandering delirium came on, and in it she begged constantly for*
75 *food and even for stimulants. She swallowed eagerly, but it was too late.*" [1] She died On
76 March 31st 1855. Reading Mrs. Gaskell's account, we were particularly struck by this
77 description of her last few days, which we have put in italics, as it seemed to us to negate
78 nearly all the suggested diagnoses and to be the crucial clue to a diagnosis, which hitherto has
79 been overlooked.

80 Her death certificate records the cause of death as phthisis (tuberculosis), but there is no
81 evidence, other than circumstantial, to support this diagnosis. It was a common debilitating
82 and fatal illness at the time, and her siblings Maria, Emily, Anne, and Branwell all died of it
83 after prolonged illness. However, in a letter to a friend, three months after her marriage, she

84 wrote, “We are all pretty well, and for my own part, it is long since I have known such
85 comparative immunity from headache, &c.” [1] She reported no cough, and the symptoms of
86 two and a half months of nausea and vomiting, followed by remission and recovery of
87 appetite, hardly fit tuberculosis or any of the other suggested infectious illnesses such as
88 typhus or typhoid. One author [7] has proposed a diagnosis of Addison’s disease caused by
89 tuberculosis of the adrenals. We consider this unlikely, since it does not fit well with two and
90 a half months of severe anorexia, nausea and vomiting, followed by remission of these
91 symptoms and eventual death. Symptoms of such severity can occur in Addisonian crisis but
92 would have been fatal in a much shorter time and would not have remitted spontaneously.
93 The one diagnosis which fits all the features of her illness between January and March, ending
94 in spontaneous remission of symptoms in the third week in March, is hyperemesis gravidarum
95 as suggested by Channing in 1857 [8] and Rhodes in 1972 [9] and discussed by Fitzgerald in
96 1979 [10] and by Coad and colleagues in 2002. [11] We are puzzled by suggestions that
97 pregnancy was unlikely. [7] She had been married for six months, the doctor who examined
98 her thought she was pregnant, and there are accounts of conversations with her servant
99 Martha Brown, in which the forthcoming child was mentioned. [1] Nausea and ‘morning
100 sickness’ are also common features of the first trimester of pregnancy, although symptoms of
101 the severity and duration described in Charlotte’s case occur in only 1% of pregnancies and
102 nowadays are treated with parenteral or enteral nutrition, anti-emetics, and intravenous fluid
103 and electrolytes, none of which were available in Charlotte’s time.

104 By the third week in March, Charlotte had lost a great deal of weight and would have been
105 malnourished, with deficiencies of protein, energy, vitamins and minerals. She would also
106 have been in negative salt and water balance, causing a postural fall in blood pressure and
107 faintness: gastric acid loss would have led to an hypochloremic alkalosis, and potassium
108 deficiency as her kidneys tried to correct the alkalosis by reabsorbing hydrogen ions in

109 exchange for potassium. These effects of her hyperemesis gravidarum would have been
110 serious in themselves, but they created an even greater risk of the refeeding syndrome, once
111 she was able eat again. This syndrome, [12] which can occur with oral or with artificial
112 refeeding was first described at the end of the second world war among malnourished
113 concentration camp survivors who were refeed too rapidly with, in many instances, fatal
114 consequences. [13, 14] It was also described by Majumdar and Dada [15] in a patient with
115 hyperemesis gravidarum who would almost certainly have died without modern treatment. Its
116 features include:

- 117 • Hypophosphatemia, as the cells take up glucose, which increases the demands on
118 phosphate reserves for phosphorylation and ATP synthesis. This causes muscle and
119 cardiac weakness, respiratory depression, delirium, coma, and death in severe cases.
- 120 • Hypokalemia, due to the action of insulin and glucose on cell membranes and the
121 increased cellular uptake of potassium as new glycogen and protein are formed.
122 Hypokalemia leads to muscle weakness and cardiac arrhythmias and would have been
123 a particular risk in a case like Charlotte's where, due to hyperemesis, hypokalemic
124 alkalosis was already present at the time of refeeding.
- 125 • Hypomagnesemia.
- 126 • Thiamine (vitamin B1) deficiency, as depleted stores of this vitamin, an essential
127 cofactor in glucose metabolism, are used up. This leads to irreversible nervous system
128 damage (Wernicke's encephalopathy).

129 Although, after a lapse of 163 years since Charlotte Bronte's death, uncertainties must
130 inevitably remain, we suggest that the diagnoses which most closely agree with the recorded
131 clinical features of her last illness are hyperemesis gravidarum complicated by the refeeding
132 syndrome. In particular, these diagnoses are compatible with the remission in her symptoms

- 133 of anorexia, nausea and vomiting in the third week of March 1855, followed by further
134 decline and death on March 31st.

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164 **Author contributions**

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166 Both authors contributed equally to the manuscript.

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