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Research Article

Etiologic Diagnosis of Pulmonary Infection using Sputum Samples and Quantitative Loop-Mediated Isothermal Amplification (qLAMP) in Tianjian, China

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Abstract

This study endeavors to assess the efficacy of quantitative loop-mediated isothermal amplification (qLAMP) technology in the diagnosis of postoperative pulmonary pathogens and to evaluate its performance with that of conventional bacterial culture methods. The study encompassed 580 patients with a cardiac history, from whom sputum samples were collected postoperatively for the purpose of conducting qLAMP and bacterial culture tests. The findings reveal that qLAMP is capable of rapidly and accurately detecting pulmonary pathogens. Furthermore, we conducted an analysis of the clinical characteristics of the patients in light of the qLAMP results, uncovering significant correlations between age, smoking index, and postoperative tissue oxygen saturation levels with the incidence of pulmonary infections. The findings emphasize the potential of qLAMP in enhancing the accuracy of postoperative pulmonary infection diagnoses, providing a new rapid diagnostic tool for clinical use.

Keywords: acute kidney injury; knee; arthroplasty

Introduction

Ischemic heart disease (ICM) is the leading global killer, accounting for 16% of the total number of deaths worldwide [1]. Although narrowings in many areas can be effectively treated by percutaneous coronary intervention (PCI), there are still some blockages that require surgical intervention. Surgical coronary artery bypass grafting (CABG) is the standard treatment for revascularization of left main or three-vessel coronary artery disease [2]. Up to 14% of patients who undergo CSBG seek medical attention within 30 days of discharge due to postoperative complications [3-5]. The postoperative complications, including sternal wound infections, pneumonia, thromboembolic phenomena, graft failure, atrial fibrillation, pulmonary hypertension, pericardial effusion, strokes, renal injury, gastrointestinal insults, and hemodynamic instability, can result in significant morbidity and mortality [6].

Pulmonary complications in the postoperative period are a significant cause of morbidity and mortality [7; 8]. In previous studies, certain interventions have been found to be effective in significantly reducing postoperative pulmonary complications. For example, it has been shown that the incidence of pulmonary complications in patients who quit smoking for more than 2 months is lower compared to those who quit smoking for 2 months or less (57.1% vs 14.5%) [9]. In addition, the incidence of postoperative pulmonary complications is lower in patients who receive preoperative lung function optimization (including bronchodilators, antibiotics, and various combinations of systemic corticosteroids) compared to patients who did not receive preoperative optimization [8]. Correct diagnosis of pathogens helps in the appropriate use of antibiotics, thereby reducing the incidence of postoperative pneumonia complications in patients.

Culture method is the gold standard for identifying bacteria and fungi, but traditional bacterial culture has low sensitivity and often delays target antibiotic therapy. Quantitative loop-mediated isothermal amplification (qLAMP) as a new implement for detecting pathogens is earlier, faster, more sensitive, and more specific than culture [10]. In this study, the culture and qLAMP methods were used to identified the potential pathogens that can cause complication in pneumonia.

An rapid innovative method for etiology identification, the quantitative loop-mediated isothermal arnplification (qLAMP), has already been used in the diagnosis of virus, fungus, parasite, and tuberculosis infections and is now commercially available [11]. It is a novel assay that focuses on the genetics of pathogens based on rapid nucleic acid amplification method. This technique has two important advantages such as rapid diagnosis and high sensitivity In addition. qLAMP is also a high specific assay,which could detect different bacteria with quantified copies. Considering the excellent timeliness and accuracy of qLAMP we initiated a pilot, prospective study to investigate the value of qLAMP to guide target antibiotics therapies in a small group of patients with Pulmonary infeciton after operation.

Materials and methods

Patients' selection

A total of 580 with a history of heart disease diagnosed by physicians in Tianjin Chest Hospital were consecutively enrolled in this study. They had typical characteristics of pneumonia, for example①fever , ②leukopenia or leukocytosis ③exacerbated dyspnea [12]. Written consent was obtained from all patients prior to recruitment. All participating researchers were trained thoroughly on patient enrollment, sample collection, and clinical information entry.

Procedures of qLAMP

The approach to sample and information collection was based on previous studies [13]. After liquefied in an equal volume of 10% NaOH, DNA specimen of each sample was isolated using the Universal Kit for Bacterial DNA Extraction (Capitalbio Corporation, China). The specimens were then prepared for qLAMP using a set of specific primers for Streptococcus pneumonia (SP), Staphylococcus aureus (SA),

Patient ID	Patient Name	Case Number	Admission Date (AA001)	Gender (AA002)	Age(AA003)	Pneumonia	Smoking History(AA015)
633	S1	S07465	2022-02-15	Female	65	NO	Previously
994	S2	S17307	2022-07-05	Male	65	NO	Never
1111	S3	S18075	2022-07-14	Male	57	NO	Previously
469	S4	S03621	2021-12-07	Female	61	NO	Never
621	S5	S06739	2022-02-09	Female	65	NO	Never
637	S6	S07430	2022-02-16	Male	63	YES	Previously
670	S7	S08943	2022-03-03	Male	70	NO	Within 6 weeks
714	S8	R71310	2022-03-24	Male	63	NO	Previously
731	S9	S11010	2022-04-01	Male	79	NO	Never
745	S10	S11155	2022-04-11	Male	73	NO	Previously
768	S11	S12196	2022-04-19	Male	62	NO	Never
769	S12	S12090	2022-04-19	Male	55	YES	Within 6 weeks
800	S13	T34652	2022-04-27	Male	62	YES	Never
877	S14	S14177	2022-05-24	Male	63	NO	Within 6 weeks
888	S15	S14555	2022-05-26	Male	68	NO	Never
939	S16	S15699	2022-06-14	Male	64	NO	Never
942	S17	S16032	2022-06-14	Male	78	NO	Never
959	S18	S16485	2022-06-21	Male	69	NO	Within 6 weeks
960	S19	S16308	2022-06-21	Female	56	YES	Never
982	S20	S16839	2022-06-30	Male	63	NO	Never
984	S21	S16799	2022-06-30	Male	73	NO	Within 6 weeks
1001	S22	S17593	2022-07-06	Male	75	NO	Previously
1106	S23	S17857	2022-07-13	Male	61	NO	Previously
1110	S24	S17984	2022-07-14	Male	60	NO	Within 6 weeks
1115	S25	S18190	2022-07-18	Male	71	NO	Previously
1132	S26	S18498	2022-07-22	Female	72	NO	Never
479	S27	S03677	2021-12-09	Male	69	NO	Previously
486	S28	S03749	2021-12-13	Male	72	NO	Never
488	S29	R37681	2021-12-13	Male	70	NO	Previously
506	S30	S04089	2021-12-17	Female	69	NO	Never
507	S31	S03264	2021-12-17	Female	77	NO	Never
509	S32	S04163	2021-12-20	Male	61	NO	Recently
557	S33	S05283	2022-01-04	Male	65	NO	Never
566	S34	S06013	2022-01-06	Male	69	NO	Within 6 weeks
574	S35	T14192	2022-01-08	Male	45	NO	Previously
577	S36	S03497	2022-01-10	Female	71	NO	Within 6 weeks
589	S37	R60882	2022-01-14	Male	62	NO	Previously
592	S38	S06158	2022-01-18	Male	68	NO	Within 6 weeks
595	S39	S06083	2022-01-19	Male	79	YES	Previously

596	S40	S06357	2022-01-19	Male	67	NO	Previously
605	S41	S06646	2022-01-26	Male	58	NO	Within 6 weeks
610	S42	S06795	2022-01-28	Male	69	NO	Within 6 weeks
624	S43	S07059	2022-02-10	Male	74	NO	Within 6 weeks
625	S44	R49153	2022-02-11	Male	63	NO	Within 6 weeks
627	S45	S02417	2022-02-11	Female	67	NO	Never
634	S46	T90906	2022-02-15	Male	63	NO	Previously
636	S47	S07797	2022-02-21	Male	72	NO	Never
642	S48	S07836	2022-02-18	Male	68	NO	Within 6 weeks
643	S49	S07981	2022-02-20	Female	73	NO	Within 6 weeks
650	S50	R96138	2022-02-23	Male	67	YES	Previously
654	S51	S08274	2022-02-24	Male	60	NO	Never
660	S52	T47400	2022-02-28	Male	72	NO	Previously
662	S53	S08554	2022-02-28	Male	73	NO	Previously
663	S54	S08386	2022-03-01	Male	68	NO	Previously
686	S55	S09441	2022-03-10	Male	81	NO	Never
697	S56	S09762	2022-03-16	Male	62	YES	Never
700	S57	S08654	2022-03-17	Male	69	NO	Previously
707	S58	S10185	2022-03-21	Male	61	YES	Within 6 weeks
708	S59	S09130	2022-03-22	Male	79	NO	Previously
713	S60	S10320	2022-03-23	Male	68	NO	Within 6 weeks
718	S61	S10741	2022-03-28	Male	74	YES	Within 6 weeks
719	S62	S10154	2022-03-28	Male	66	NO	Previously
748	S63	S11604	2022-04-12	Female	75	NO	Previously
755	S64	S11710	2022-04-13	Male	79	NO	Previously
765	S65	S12165	2022-04-18	Male	80	NO	Previously
770	S66	S11872	2022-04-19	Female	75	NO	Within 6 weeks
773	S67	R07653	2022-04-20	Male	66	YES	Previously
802	S68	S08908	2022-04-27	Male	66	NO	Within 6 weeks
822	S69	S13161	2022-05-07	Male	61	NO	Within 6 weeks
827	S70	S13345	2022-05-09	Female	68	NO	Never
830	S71	S12818	2022-05-09	Female	56	NO	Never
832	S72	S13092	2022-05-10	Male	35	NO	Previously
839	S73	S13704	2022-05-11	Male	63	NO	Within 6 weeks
841	S74	S13510	2022-05-12	Male	71	NO	Within 6 weeks
846	S75	S13054	2022-05-13	Male	76	NO	Previously
873	S76	S14418	2022-05-23	Male	61	NO	Within 6 weeks
875	S77	S14399	2022-05-23	Male	68	YES	Recently
879	S78	R80255	2022-05-24	Male	65	YES	Previously
880	S79	S14389	2022-05-24	Male	60	NO	Never
882	S80	S14505	2022-05-25	Male	63	NO	Within 6 weeks
889	S81	S14702	2022-05-27	Female	66	NO	Within 6 weeks
891	S82	S14604	2022-05-26	Female	57	NO	Never
892	S83	S14597	2022-05-27	Male	59	NO	Previously
896	S84	S14696	2022-05-30	Male	70	NO	Within 6 weeks
919	S85	S15538	2022-06-07	Male	60	NO	Previously
924	S86	S15314	2022-06-08	Male	46	NO	Never
932	S87	S15666	2022-06-10	Male	58	NO	Within 6 weeks
933	S88	S15148	2022-06-10	Female	68	NO	Within 6 weeks
934	S89	S15441	2022-06-13	Male	67	NO	Previously
940	S90	S15601	2022-06-14	Male	62	NO	Within 6 weeks
946	S91	S15999	2022-06-15	Male	64	NO	Within 6 weeks
948	S92	S15887	2022-06-16	Male	54	NO	Within 6 weeks
962	S93	S16459	2022-06-22	Male	74	NO	Within 6 weeks
964	S94	S14589	2022-06-23	Male	74	NO	Never
974	S95	S16960	2022-06-27	Male	65	NO	Never
978	S96	S16880	2022-06-29	Female	78	NO	Previously
992	S97	S17172	2022-07-04	Male	42	NO	Within 6 weeks
995	S98	S17322	2022-07-05	Male	63	YES	Within 6 weeks
997	S99	S17350	2022-07-05	Male	69	YES	Previously
1005	S100	S17727	2022-07-08	Male	70	NO	Within 6 weeks
1009	S101	S17820	2022-07-11	Female	69	NO	Never
1107	S102	S17835	2022-07-13	Male	72	NO	Never

1120	S103	S18118	2022-07-19	Male	66	NO	Previously
1121	S104	S18330	2022-07-20	Female	59	NO	Never
1123	S105	R04519	2022-07-20	Male	65	NO	Never
1130	S106	S18425	2022-07-22	Male	48	NO	Within 6 weeks
1131	S107	S18054	2022-07-22	Male	62	NO	Within 6 weeks
1135	S108	T72067	2022-07-25	Female	69	NO	Previously
1137	S109	S18721	2022-07-25	Male	68	NO	Never
1148	S110	S19102	2022-07-28	Female	65	NO	Never
445	S111	T05927	2021-11-26	Male	70	YES	Previously
484	S112	R98520	2021-12-13	Male	79	NO	Previously
487	S113	S03589	2021-12-13	Male	67	NO	Within 6 weeks
490	S114	S03960	2021-12-14	Male	60	NO	Within 6 weeks
495	S115	S03888	2021-12-15	Male	68	NO	Within 6 weeks
496	S116	S03893	2021-12-15	Male	72	NO	Previously
500	S117	R47647	2021-12-16	Male	64	NO	Never
503	S118	S03610	2021-12-16	Female	51	NO	Never
504	S119	S04145	2021-12-17	Male	66	NO	Within 6 weeks
505	S120	S04116	2021-12-17	Male	65	NO	Within 6 weeks
513	S121	S04476	2021-12-20	Male	73	NO	Previously
535	S122	S04439	2021-12-27	Male	67	NO	Within 6 weeks
538	S123	S05132	2021-12-28	Female	65	NO	Never
550	S124	S05193	2021-12-30	Male	84	NO	Never
553	S125	S05168	2022-01-03	Male	61	NO	Within 6 weeks
554	S126	S05503	2022-01-03	Male	60	NO	Within 6 weeks
565	S127	S05248	2022-01-05	Male	58	NO	Within 6 weeks
568	S128	S05907	2022-01-06	Male	76	NO	Previously
576	S129	S06141	2022-01-10	Male	70	NO	Never
579	S130	S05961	2022-01-10	Male	55	NO	Previously
597	S131	S06416	2022-01-20	Male	68	NO	Within 6 weeks
600	S132	S06264	2022-01-25	Female	74	YES	Never
602	S133	S06703	2022-01-25	Male	68	NO	Never
614	S134	S06822	2022-02-07	Male	77	NO	Never
615	S135	S07014	2022-02-07	Male	57	NO	Within 6 weeks
629	S136	S07263	2022-02-14	Male	54	NO	Within 6 weeks
622	S137	S06995	2022-02-10	Male	74	NO	Previously
623	S138	R81960	2022-02-10	Male	62	NO	Previously
626	S139	S07058	2022-02-11	Male	75	NO	Within 6 weeks
631	S140	R28536	2022-02-14	Male	63	NO	Previously
638	S141	S07458	2022-02-17	Female	77	NO	Previously
639	S142	S07823	2022-02-17	Male	72	NO	Within 6 weeks
641	S143	S07424	2022-02-17	Male	69	NO	Previously
648	S144	S07572	2022-02-22	Male	71	NO	Within 6 weeks
651	S145	S07930	2022-02-23	Male	65	NO	Within 6 weeks
655	S146	T23620	2022-02-24	Male	68	NO	Within 6 weeks
657	S147	S08272	2022-02-25	Female	59	NO	Recently
659	S148	S08002	2022-02-25	Male	65	NO	Never
668	S149	S08303	2022-03-02	Female	64	NO	Never
674	S150	S09152	2022-03-08	Male	70	NO	Within 6 weeks
682	S151	S09081	2022-03-09	Male	64	YES	Previously
685	S152	S09491	2022-03-10	Male	65	NO	Previously
687	S153	S09617	2022-03-10	Male	71	NO	Never
691	S154	S08370	2022-03-14	Female	73	NO	Never
698	S155	S09776	2022-03-16	Male	64	NO	Previously
701	S156	T28907	2022-03-17	Male	71	YES	Within 6 weeks
702	S157	S10040	2022-03-17	Female	62	NO	Within 6 weeks
705	S158	S10081	2022-03-18	Male	69	NO	Recently
709	S159	T26265	2022-03-22	Male	66	NO	Within 6 weeks
710	S160	S09944	2022-03-22	Male	79	NO	Within 6 weeks
726	S161	S10647	2022-03-30	Female	71	NO	Previously
727	S162	S10539	2022-03-31	Male	56	NO	Within 6 weeks
737	S163	S10972	2022-04-06	Male	72	NO	Previously
738	S164	S11102	2022-04-07	Female	76	YES	Never
739	S165	S10839	2022-04-07	Female	60	NO	Never

741	S166	S11277	2022-04-08	Male	69	NO	Never
742	S167	T70922	2022-04-08	Male	68	YES	Recently
743	S168	S11415	2022-04-08	Male	59	NO	Never
744	S169	S11443	2022-04-11	Male	67	NO	Previously
746	S170	S11495	2022-04-11	Female	65	NO	Never
749	S171	T14361	2022-04-12	Male	75	YES	Within 6 weeks
750	S172	S11308	2022-04-12	Female	72	NO	Never
751	S173	S11608	2022-04-12	Male	49	NO	Within 6 weeks
756	S174	S11609	2022-04-14	Male	62	NO	Within 6 weeks
759	S175	S11702	2022-04-14	Male	69	NO	Never
761	S176	S11287	2022-04-15	Male	69	NO	Within 6 weeks
762	S177	S11830	2022-04-15	Female	73	NO	Never
766	S178	S11852	2022-04-18	Male	75	NO	Previously
771	S179	S12030	2022-04-19	Male	39	NO	Within 6 weeks
774	S180	S11948	2022-04-20	Male	76	YES	Previously
775	S181	S11651	2022-04-20	Male	65	NO	Within 6 weeks
777	S182	R31179	2022-04-20	Male	45	NO	Within 6 weeks
778	S183	S12041	2022-04-21	Male	64	NO	Within 6 weeks
781	S184	S12358	2022-04-21	Male	66	NO	Within 6 weeks
788	S185	S12612	2022-04-24	Female	80	NO	Never
791	S186	S12279	2022-04-25	Male	73	NO	Never
792	S187	S12611	2022-04-25	Male	75	NO	Previously
793	S188	S12685	2022-04-25	Male	77	NO	Never
795	S189	T01667	2022-04-26	Male	70	NO	Never
797	S190	S12794	2022-04-26	Male	72	NO	Previously
798	S191	S12507	2022-04-26	Male	66	NO	Recently
803	S192	S12692	2022-04-27	Male	58	YES	Within 6 weeks
805	S193	S12561	2022-04-28	Male	72	NO	Previously
807	S194	T28119	2022-04-28	Male	64	NO	Recently
808	S195	S13040	2022-04-29	Male	65	NO	Within 6 weeks
809	S196	S12900	2022-04-29	Male	80	YES	Previously
810	S197	S12643	2022-05-04	Male	68	YES	Within 6 weeks
811	S198	T63815	2022-04-29	Male	58	NO	Within 6 weeks
817	S199	S13070	2022-05-05	Male	65	YES	Within 6 weeks
820	S200	S12899	2022-05-06	Male	73	YES	Previously
821	S201	S13176	2022-05-07	Male	61	NO	Within 6 weeks
823	S202	S13261	2022-05-07	Female	79	NO	Previously
824	S203	S13374	2022-05-07	Male	67	NO	Never
826	S204	S13483	2022-05-09	Female	71	NO	Within 6 weeks
833	S205	S13116	2022-05-10	Male	77	NO	Previously
855	S206	S14223	2022-05-17	Male	70	NO	Never
858	S207	R06923	2022-05-17	Male	67	NO	Within 6 weeks
862	S208	S14373	2022-05-18	Male	50	NO	Within 6 weeks
876	S209	T49805	2022-05-23	Female	69	YES	Never
878	S210	S13808	2022-05-24	Male	67	NO	Previously
885	S211	S14607	2022-05-25	Male	63	NO	Within 6 weeks
898	S212	S11668	2022-05-30	Male	56	NO	Within 6 weeks
902	S213	S15151	2022-06-01	Female	80	NO	Never
927	S214	S15440	2022-06-09	Male	66	NO	Previously
930	S215	S15306	2022-06-10	Female	74	NO	Never
931	S216	S15819	2022-06-10	Male	72	YES	Never
935	S217	S15456	2022-06-13	Male	62	NO	Within 6 weeks
941	S218	S15823	2022-06-15	Male	59	NO	Never
943	S219	S15617	2022-06-15	Male	68	NO	Previously
952	S220	S16159	2022-06-17	Male	70	YES	Within 6 weeks
953	S221	S15806	2022-06-17	Male	63	NO	Previously
955	S222	S16079	2022-06-20	Male	71	NO	Never
956	S223	S16389	2022-06-21	Male	66	NO	Within 6 weeks
963	S224	S16299	2022-06-22	Male	49	NO	Within 6 weeks
965	S225	S16373	2022-06-23	Male	67	NO	Within 6 weeks
966	S226	S16633	2022-06-23	Male	56	NO	Previously
968	S227	S16537	2022-06-24	Male	70	NO	Never
975	S228	S16877	2022-06-28	Female	55	NO	Never

976	S229	T08864	2022-06-28	Male	64	NO	Within 6 weeks
977	S230	S16466	2022-06-28	Female	72	YES	Never
979	S231	S16830	2022-06-29	Male	49	NO	Within 6 weeks
980	S232	S16749	2022-06-29	Male	75	NO	Previously
988	S233	S16375	2022-07-01	Male	62	YES	Within 6 weeks
990	S234	S17088	2022-07-04	Male	73	YES	Within 6 weeks
998	S235	S17331	2022-07-06	Male	59	NO	Never
1002	S236	S17528	2022-07-07	Male	65	NO	Within 6 weeks
1003	S237	S17434	2022-07-07	Male	68	NO	Never
1100	S238	S17821	2022-07-11	Female	62	YES	Never
1102	S239	T01274	2022-07-12	Female	76	NO	Previously
1104	S240	S17445	2022-07-12	Male	43	NO	Within 6 weeks
1105	S241	S18057	2022-07-12	Male	47	NO	Never
1108	S242	S17969	2022-07-13	Female	69	NO	Within 6 weeks
1113	S243	S18074	2022-07-15	Male	58	NO	Previously
1116	S244	R00118	2022-07-18	Male	79	NO	Previously
1117	S245	S16576	2022-07-18	Male	68	NO	Recently
1122	S246	S18684	2022-07-20	Female	60	NO	Within 6 weeks
1126	S247	S18386	2022-07-21	Female	63	NO	Never
1127	S248	S18183	2022-07-21	Male	72	NO	Previously
1134	S249	S18839	2022-07-25	Male	71	NO	Within 6 weeks
1140	S250	S18870	2022-07-26	Male	70	NO	Previously
1142	S251	S18914	2022-07-27	Male	65	NO	Never
1143	S252	S18755	2022-07-27	Male	68	NO	Previously
471	S253	S03371	2021-12-08	Male	54	NO	Never
474	S254	T79395	2021-12-08	Male	55	NO	Never
478	S255	S03260	2021-12-09	Female	61	NO	Within 6 weeks
481	S256	S03460	2021-12-10	Male	71	NO	Within 6 weeks
483	S257	R83711	2021-12-10	Female	75	NO	Never
485	S258	S03740	2021-12-13	Male	61	NO	Within 6 weeks
494	S259	S04129	2021-12-15	Male	67	NO	Within 6 weeks
497	S260	R00627	2021-12-15	Male	76	NO	Previously
501	S261	S04746	2021-12-21	Male	65	NO	Never
502	S262	S03978	2021-12-16	Male	63	NO	Within 6 weeks
510	S263	S03938	2021-12-20	Female	65	YES	Never
511	S264	T99379	2021-12-20	Female	72	YES	Never
512	S265	T10451	2021-12-20	Male	61	NO	Within 6 weeks
518	S266	S04333	2021-12-21	Male	57	NO	Within 6 weeks
523	S267	S04793	2021-12-22	Male	57	NO	Within 6 weeks
526	S268	S03748	2021-12-23	Male	63	NO	Within 6 weeks
527	S269	S04559	2021-12-23	Male	66	NO	Recently
528	S270	S04484	2021-12-23	Male	57	NO	Recently
530	S271	T27933	2021-12-24	Female	64	NO	Within 6 weeks
532	S272	S05007	2021-12-24	Male	63	NO	Within 6 weeks
533	S273	S04861	2021-12-27	Female	72	NO	Never
546	S274	S05321	2021-12-29	Male	67	NO	Never
556	S275	S05449	2022-01-03	Male	57	NO	Previously
561	S276	S05930	2022-01-05	Female	75	NO	Never
563	S277	S05638	2022-01-05	Male	59	NO	Previously
572	S278	S02607	2022-01-08	Male	62	NO	Within 6 weeks
578	S279	S06522	2022-01-22	Male	64	NO	Within 6 weeks
580	S280	T32051	2022-01-10	Male	72	YES	Within 6 weeks
581	S281	S05954	2022-01-10	Male	53	NO	Never
583	S282	S05668	2022-01-12	Male	71	NO	Previously
584	S283	S04499	2022-01-12	Male	58	NO	Within 6 weeks
585	S284	S06547	2022-01-22	Male	59	NO	Previously
591	S285	S06226	2022-01-17	Male	65	YES	Within 6 weeks
594	S286	S06398	2022-01-18	Male	76	NO	Within 6 weeks
598	S287	S06495	2022-01-20	Male	64	YES	Recently
599	S288	R60755	2022-01-24	Female	69	NO	Never
607	S289	S06727	2022-01-27	Male	52	NO	Within 6 weeks
609	S290	S06760	2022-01-28	Male	58	NO	Within 6 weeks
613	S291	S06829	2022-01-29	Male	66	NO	Never

616	S292	S06836	2022-02-07	Female	60	NO	Never
617	S293	S07157	2022-02-08	Male	59	NO	Never
618	S294	S07135	2022-02-08	Male	71	NO	Within 6 weeks
620	S295	S07043	2022-02-09	Male	69	NO	Previously
630	S296	S07398	2022-02-14	Male	73	YES	Recently
632	S297	S06963	2022-02-15	Male	65	NO	Within 6 weeks
635	S298	S07621	2022-02-16	Male	69	NO	Within 6 weeks
640	S299	S07562	2022-02-17	Male	61	NO	Never
644	S300	S06860	2022-02-18	Male	62	NO	Within 6 weeks
645	S301	S07407	2022-02-21	Male	67	NO	Previously
646	S302	S07907	2022-02-21	Male	76	NO	Never
647	S303	S07900	2022-02-22	Male	67	NO	Within 6 weeks
649	S304	S08029	2022-02-22	Male	65	NO	Within 6 weeks
652	S305	S08375	2022-02-23	Female	64	NO	Within 6 weeks
653	S306	S08358	2022-02-24	Female	64	NO	Never
656	S307	S08081	2022-02-25	Male	73	NO	Never
658	S308	S08135	2022-02-25	Female	72	NO	Never
661	S309	S08462	2022-02-28	Female	67	NO	Never
664	S310	S08509	2022-03-01	Female	68	NO	Never
665	S311	S08562	2022-03-01	Female	65	NO	Never
666	S312	S08319	2022-03-01	Male	64	NO	Within 6 weeks
667	S313	S08851	2022-03-02	Male	69	NO	Previously
669	S314	S08474	2022-03-03	Female	66	YES	Never
671	S315	R75753	2022-03-04	Female	62	NO	Never
672	S316	S08299	2022-03-04	Male	64	NO	Never
673	S317	R99018	2022-03-07	Male	61	NO	Recently
675	S318	S08841	2022-03-07	Male	55	YES	Previously
676	S319	S08610	2022-03-08	Female	69	YES	Never
677	S320	S08912	2022-03-09	Male	70	NO	Never
678	S321	S09381	2022-03-08	Male	66	NO	Within 6 weeks
679	S322	S08705	2022-03-08	Male	72	NO	Within 6 weeks
680	S323	S06192	2022-03-09	Male	64	NO	Never
681	S324	R87777	2022-03-09	Male	65	NO	Within 6 weeks
683	S325	S09126	2022-03-09	Male	57	NO	Never
684	S326	S09074	2022-03-10	Male	72	NO	Within 6 weeks
688	S327	S09486	2022-03-11	Female	68	NO	Previously
689	S328	S09477	2022-03-11	Male	73	NO	Previously
690	S329	S09373	2022-03-11	Male	68	YES	Within 6 weeks
692	S330	S09571	2022-03-14	Female	64	YES	Never
693	S331	T02055	2022-03-14	Male	73		Previously
694	S332	S09578	2022-03-15	Male	66	NO	Within 6 weeks
695	S333	S09707	2022-03-15	Female	66	NO	Never
696	S334	S09623	2022-03-15	Male	67	NO	Never
699	S335	S09510	2022-03-16	Male	64	NO	Never
703	S336	S10147	2022-03-18	Male	67	NO	Never
704	S337	S10064	2022-03-18	Female	68	NO	Never
706	S338	S10059	2022-03-21	Male	67	NO	Within 6 weeks
711	S339	S10279	2022-03-23	Female	69	NO	Within 6 weeks
712	S340	T08804	2022-03-23	Female	68	NO	Never
715	S341	S10177	2022-03-24	Male	68	NO	Never
716	S342	S10599	2022-03-25	Female	67	NO	Never
717	S343	S10346	2022-03-27	Male	64	NO	Previously
720	S344	S10612	2022-03-28	Male	58	NO	Never
721	S345	S10886	2022-03-29	Female	69	NO	Never
722	S346	S10690	2022-03-29	Male	68	NO	Never
723	S347	S10673	2022-03-29	Male	59	NO	Within 6 weeks
724	S348	S10715	2022-03-30	Male	58	NO	Never
725	S349	S10914	2022-03-30	Male	69	NO	Never
729	S350	S10298	2022-03-31	Female	67	NO	Never
730	S351	S10971	2022-04-01	Male	68	NO	Never
733	S352	S10967	2022-04-02	Female	71	YES	Never
734	S353	S10889	2022-04-02	Male	61	NO	Within 6 weeks
735	S354	S11110	2022-04-02	Female	73	YES	Never

736	S355	R97612	2022-04-06	Male	62	NO	Never
740	S356	T46383	2022-04-07	Male	67	NO	Never
747	S357	S11242	2022-04-11	Male	59	NO	Within 6 weeks
752	S358	S11799	2022-04-13	Male	66	NO	Never
753	S359	S11408	2022-04-13	Male	71	NO	Previously
754	S360	S11233	2022-04-13	Female	80	NO	Never
757	S361	S11675	2022-04-14	Male	75	NO	Within 6 weeks
758	S362	S11922	2022-04-14	Male	38	YES	Never
760	S363	S11453	2022-04-15	Male	80	NO	Never
763	S364	S03999	2022-04-15	Female	66	NO	Never
764	S365	S11996	2022-04-18	Male	68	NO	Previously
767	S366	S11903	2022-04-18	Male	73	NO	Previously
772	S367	S11945	2022-04-19	Female	73	YES	Within 6 weeks
776	S368	S11615	2022-04-20	Male	77	NO	Within 6 weeks
779	S369	S12437	2022-04-21	Male	61	NO	Never
780	S370	S11575	2022-04-21	Female	75	NO	Never
782	S371	S11562	2022-04-21	Male	51	NO	Within 6 weeks
783	S372	S12232	2022-04-21	Female	65	NO	Never
784	S373	R35378	2022-04-22	Female	67	NO	Never
785	S374	S12494	2022-04-22	Male	79	NO	Never
786	S375	S12510	2022-04-22	Female	74	NO	Within 6 weeks
787	S376	S12394	2022-04-22	Female	64	YES	Never
789	S377	S11784	2022-04-24	Male	66	NO	Previously
790	S378	S12317	2022-04-24	Male	69	NO	Within 6 weeks
794	S379	S12462	2022-04-25	Male	43	NO	Previously
796	S380	S12132	2022-04-26	Male	71	NO	Within 6 weeks
799	S381	S12617	2022-04-26	Female	69	NO	Within 6 weeks
801	S382	S11753	2022-04-27	Male	55	YES	Within 6 weeks
813	S383	S12497	2022-05-05	Male	71	NO	Never
814	S384	S12942	2022-05-05	Female	61	YES	Never
815	S385	S12968	2022-05-05	Male	51	NO	Within 6 weeks
816	S386	T62020	2022-05-05	Female	72	NO	Never
818	S387	T92235	2022-05-06	Female	63	NO	Never
819	S388	S13388	2022-05-06	Male	70	NO	Within 6 weeks
825	S389	S13075	2022-05-07	Female	69	NO	Never
828	S390	S13530	2022-05-09	Female	68	NO	Never
829	S391	S13119	2022-05-09	Male	77	NO	Within 6 weeks
831	S392	S13326	2022-05-10	Female	67	NO	Never
834	S393	T69123	2022-05-11	Male	60	NO	Previously
835	S394	S13544	2022-05-10	Male	60	NO	Within 6 weeks
836	S395	S12985	2022-05-11	Male	68	NO	Within 6 weeks
837	S396	S13363	2022-05-11	Male	71	NO	Within 6 weeks
838	S397	S13329	2022-05-11	Male	71	YES	Within 6 weeks
842	S398	S13570	2022-05-12	Male	72	NO	Within 6 weeks
843	S399	S13872	2022-05-12	Female	63	NO	Never
844	S400	S13273	2022-05-13	Female	71	NO	Never
845	S401	S05757	2022-05-13	Female	70	YES	Never
847	S402	S13659	2022-05-13	Male	66	NO	Never
848	S403	S13676	2022-05-13	Male	67	NO	Within 6 weeks
849	S404	S14002	2022-05-16	Male	67	NO	Within 6 weeks
850	S405	S14040	2022-05-16	Male	69	NO	Within 6 weeks
851	S406	S13029	2022-05-16	Male	69	NO	Previously
852	S407	S13792	2022-05-16	Male	62	NO	Never
853	S408	S13779	2022-05-16	Male	64	NO	Within 6 weeks
854	S409	S13982	2022-05-16	Male	66	NO	Within 6 weeks
856	S410	S14203	2022-05-17	Female	69	NO	Within 6 weeks
857	S411	S14020	2022-05-17	Male	76	NO	Never
859	S412	S13834	2022-05-17	Male	60	NO	Within 6 weeks
860	S413	S14102	2022-05-18	Female	71	YES	Never
861	S414	S13803	2022-05-18	Female	70	NO	Never
863	S415	S14226	2022-05-18	Female	50	YES	Never
864	S416	S14319	2022-05-19	Male	73	NO	Within 6 weeks
865	S417	R17156	2022-05-19	Male	72	NO	Previously

866	S418	S13727	2022-05-19	Male	76	NO	Never
867	S419	S14268	2022-05-19	Male	61	NO	Within 6 weeks
868	S420	S14089	2022-05-20	Female	75	NO	Never
869	S421	S14362	2022-05-20	Male	69	NO	Within 6 weeks
870	S422	S13969	2022-05-20	Male	77	YES	Never
871	S423	S14095	2022-05-20	Female	50	NO	Never
872	S424	S14228	2022-05-23	Male	65	NO	Never
874	S425	S14110	2022-05-23	Female	68	NO	Never
881	S426	S14141	2022-05-24	Female	67	YES	Never
883	S427	S14424	2022-05-25	Female	63	NO	Never
884	S428	S14033	2022-05-25	Male	67	NO	Within 6 weeks
887	S429	S14508	2022-05-26	Male	59	NO	Within 6 weeks
890	S430	S14483	2022-05-26	Male	53	NO	Within 6 weeks
893	S431	S13702	2022-05-27	Male	72	YES	Previously
894	S432	S14614	2022-05-30	Female	70	NO	Previously
895	S433	S14592	2022-05-30	Female	70	NO	Never
897	S434	S15036	2022-05-31	Male	66	NO	Never
899	S435	S13202	2022-05-31	Male	60	NO	Previously
900	S436	S15169	2022-05-31	Female	71	NO	Previously
901	S437	S14788	2022-05-31	Male	48	NO	Never
903	S438	T58694	2022-06-01	Male	63	NO	Previously
904	S439	S09301	2022-06-01	Male	52	NO	Recently
905	S440	S15077	2022-06-01	Female	57	NO	Never
906	S441	S14713	2022-06-02	Female	60	NO	Within 6 weeks
907	S442	S15070	2022-06-02	Female	66	NO	Never
908	S443	S15008	2022-06-02	Male	68	NO	Previously
909	S444	S13589	2022-06-02	Male	61	YES	Within 6 weeks
910	S445	S15329	2022-06-05	Male	67	NO	Previously
911	S446	S15104	2022-06-06	Male	61	NO	Previously
912	S447	R56879	2022-06-06	Female	66	NO	Never
913	S448	S15090	2022-06-06	Male	64	NO	Never
914	S449	S15354	2022-06-06	Male	65	NO	Within 6 weeks
915	S450	S15233	2022-06-06	Male	67	YES	Previously
916	S451	S15360	2022-06-07	Male	73	NO	Previously
917	S452	S15485	2022-06-09	Male	62	NO	Within 6 weeks
920	S453	S15318	2022-06-07	Female	63	NO	Never
921	S454	S15275	2022-06-08	Male	81	NO	Never
922	S455	S15401	2022-06-08	Male	74	NO	Previously
923	S456	S15126	2022-06-08	Male	67	NO	Never
925	S457	S15017	2022-06-09	Male	81	YES	Never
926	S458	S15669	2022-06-09	Male	68	NO	Within 6 weeks
928	S459	S15529	2022-06-09	Male	65	NO	Recently
936	S460	S15771	2022-06-13	Male	87	NO	Previously
937	S461	S15316	2022-06-13	Male	61	NO	Within 6 weeks
938	S462	S15755	2022-06-13	Male	50	NO	Previously
944	S463	S14768	2022-05-27	Male	64	NO	Within 6 weeks
945	S464	S11938	2022-05-27	Male	66	NO	Never
947	S465	S16143	2022-06-16	Male	44	NO	Within 6 weeks
949	S466	S15214	2022-06-16	Female	79	NO	Previously
950	S467	S15908	2022-06-16	Male	64	NO	Previously
951	S468	S11209	2022-06-17	Female	61	NO	Previously
954	S469	S15844	2022-06-17	Male	51	NO	Within 6 weeks
957	S470	S15919	2022-06-20	Male	59	NO	Never
958	S471	S14648	2022-06-20	Male	62	NO	Never
961	S472	S16331	2022-06-22	Female	67	NO	Never
967	S473	T43883	2022-06-23	Female	75	NO	Never
969	S474	S16193	2022-06-24	Male	47	NO	Within 6 weeks
970	S475	S16793	2022-06-24	Male	55	NO	Never
971	S476	S15575	2022-06-27	Male	59	NO	Previously
972	S477	S16100	2022-06-27	Male	65	NO	Within 6 weeks
973	S478	S16675	2022-06-27	Male	68	NO	Never
981	S479	S17000	2022-06-29	Female	77	NO	Previously
985	S480	S17308	2022-07-01	Female	67	NO	Never

986	S481	S14561	2022-07-01	Female	67	NO	Never
987	S482	S16929	2022-07-01	Female	68	NO	Never
989	S483	S17112	2022-07-03	Male	70	NO	Within 6 weeks
991	S484	S17320	2022-07-04	Male	72	NO	Never
993	S485	S17122	2022-07-04	Female	59	NO	Never
996	S486	S17306	2022-07-05	Female	69	NO	Never
999	S487	S17381	2022-07-06	Female	54	NO	Never
1000	S488	S17156	2022-07-06	Male	69	NO	Within 6 weeks
1004	S489	S17577	2022-07-08	Male	53	NO	Within 6 weeks
1006	S490	S17144	2022-07-08	Female	70	NO	Never
1007	S491	S16719	2022-06-28	Male	76	NO	Recently
1008	S492	S17848	2022-07-11	Male	76	NO	Within 6 weeks
1101	S493	S18180	2022-07-14	Male	73	NO	Never
1103	S494	S18030	2022-07-12	Female	60	NO	Never
1109	S495	S17713	2022-07-14	Male	72	NO	Never
1112	S496	S17997	2022-07-15	Female	77	NO	Never
1114	S497	S18108	2022-07-18	Male	63	NO	Never
1118	S498	S18221	2022-07-19	Male	62	NO	Within 6 weeks
1119	S499	S17747	2022-07-19	Male	77	NO	Within 6 weeks
1124	S500	S18286	2022-07-20	Male	75	NO	Previously
1125	S501	S18639	2022-07-20	Male	73	YES	Never
1128	S502	S18492	2022-07-21	Male	62	NO	Within 6 weeks
1129	S503	S18645	2022-07-21	Male	63	NO	Never
1133	S504	S18336	2022-07-22	Male	77	NO	Never
1136	S505	S18395	2022-07-25	Male	65	NO	Never
1138	S506	S18880	2022-07-26	Male	66	NO	Never
1139	S507	S18627	2022-07-26	Male	65	NO	Within 6 weeks
1144	S508	S19116	2022-07-27	Female	71	NO	Previously
1145	S509	S18928	2022-07-27	Male	72	NO	Within 6 weeks
1146	S510	S18744	2022-07-28	Female	65	NO	Never
1147	S511	S18480	2022-07-28	Male	66	NO	Within 6 weeks
1149	S512	S19129	2022-07-28	Male	57	NO	Within 6 weeks
460	S513	S03099	2021-12-02	Male	60	NO	Never
461	S514	S01850	2021-12-02	Male	53	NO	Never
464	S515	S03710	2021-12-08	Male	70	NO	Previously
465	S516	S02851	2021-12-07	Male	65	NO	Never
470	S517	S03657	2021-12-07	Male	72	NO	Never
472	S518	S03142	2021-12-08	Male	76	NO	Within 6 weeks
473	S519	S03344	2021-12-08	Male	62	YES	Previously
475	S520	S02147	2021-12-08	Male	66	NO	Within 6 weeks
476	S521	S02870	2021-12-09	Male	56	NO	Never
477	S522	S03642	2021-12-09	Male	73	NO	Previously
480	S523	S02629	2021-12-10	Male	76	NO	Previously
482	S524	S04052	2021-12-10	Female	65	NO	Never
489	S525	S03890	2021-12-14	Female	71	NO	Never
491	S526	T80952	2021-12-14	Male	68	NO	Within 6 weeks
492	S527	S04176	2021-12-14	Female	61	NO	Never
493	S528	S03881	2021-12-14	Male	65	NO	Within 6 weeks
499	S529	S04428	2021-12-16	Male	68	YES	Never
508	S530	S04239	2021-12-17	Female	60	NO	Within 6 weeks
514	S531	S04267	2021-12-21	Male	68	NO	Never
515	S532	S04341	2021-12-21	Male	76	NO	Never
516	S533	S04285	2021-12-21	Male	67	NO	Never
519	S534	S04401	2021-12-22	Male	66	NO	Within 6 weeks
520	S535	S04197	2021-12-22	Female	69	NO	Within 6 weeks
521	S536	S04873	2021-12-22	Female	70	NO	Never
522	S537	S04741	2021-12-24	Female	56	NO	Never
524	S538	S02155	2021-12-23	Male	68	NO	Previously
525	S539	R64659	2021-12-23	Female	83	NO	Previously
529	S540	S03747	2021-12-24	Female	59	YES	Never
531	S541	T68966	2021-12-24	Female	76	NO	Never
534	S542	S04172	2021-12-27	Male	71	NO	Within 6 weeks
536	S543	S05203	2021-12-29	Male	64	NO	Within 6 weeks

537	S544	S05279	2021-12-27	Female	70	NO	Never
539	S545	S04993	2021-12-28	Female	62	NO	Never
540	S546	S04452	2021-12-28	Male	68	NO	Previously
541	S547	S05198	2021-12-28	Male	77	NO	Recently
542	S548	S04848	2021-12-28	Male	76	NO	Previously
543	S549	S05111	2021-12-29	Male	73	YES	Never
544	S550	S04445	2021-12-29	Male	75	NO	Never
545	S551	S05543	2021-12-30	Female	75	NO	Never
547	S552	S04816	2021-12-29	Male	63	NO	Within 6 weeks
548	S553	S05484	2021-12-30	Male	71	NO	Recently
549	S554	S05178	2021-12-30	Male	62	NO	Within 6 weeks
552	S555	S05536	2022-01-03	Male	68	NO	Previously
558	S556	S05196	2022-01-04	Male	69	YES	Within 6 weeks
559	S557	S05580	2022-01-04	Female	50	NO	Never
560	S558	S05018	2022-01-04	Male	58	NO	Within 6 weeks
562	S559	S05895	2022-01-05	Female	67	NO	Within 6 weeks
564	S560	S05090	2022-01-05	Male	47	NO	Within 6 weeks
567	S561	S05917	2022-01-06	Male	53	NO	Within 6 weeks
569	S562	S05902	2022-01-06	Male	64	NO	Previously
570	S563	S05791	2022-01-06	Male	77	NO	Previously
571	S564	S06028	2022-01-08	Female	56	NO	Never
573	S565	S05845	2022-01-08	Male	52	NO	Within 6 weeks
575	S566	R25239	2022-01-08	Male	64	NO	Within 6 weeks
582	S567	S05982	2022-01-11	Female	79	YES	Never
586	S568	S06304	2022-01-13	Male	59	NO	Previously
588	S569	T24545	2022-01-14	Male	68	NO	Previously
590	S570	S06322	2022-01-17	Female	63	NO	Never
601	S571	S06621	2022-01-25	Female	65	NO	Never
603	S572	S06455	2022-01-27	Male	65	NO	Within 6 weeks
604	S573	S06702	2022-01-26	Female	66	NO	Never
606	S574	S06695	2022-01-26	Male	72	NO	Within 6 weeks
608	S575	S06805	2022-01-28	Male	59	NO	Within 6 weeks
611	S576	S06837	2022-01-29	Male	65	NO	Within 6 weeks
612	S577	T30067	2022-01-29	Male	69	NO	Previously
619	S578	S06813	2022-02-09	Female	62	YES	Never
628	S579	S06994	2022-02-08	Female	65	YES	Never

Table S1. Clinical information of 580 patients with histories of coronary heart diseases

Congruence of qLAMP and culture assays

We analyzed 472 patients were conducted qLAMP as well as culture assays (Table S3). In culture assays, although we found 48 bacterial species and 6 fungi species in total, only the eight species in the pathogen panel were taken into account. Totally, 269 of 480 patients were detected one of the eight species in culture assays. Among them, 143 of 269 patients obtain the consistent pathogen, that is the pathogen detected by the culture assay was contained in the positive pathogens of qLAMP assays. In details, KP got the highest concordance rate of 86.0%, which was far above other seven pathogens (See details in Table 2).

Eight-pathogen panel of qLAMP	No. of patients
Acinetobacter baumannii (AB)	10
Klebsiella pneumonia (KP)	153
Streptococcus pneumonia (SP)	32
Staphylococcus aureus (SA)	34
Haemophilus influenza (HI)	170
Methicillin resistant Staphylococcus (MRSA)	51
Stenotrophomonas maltophilia (SM)	2
Pseudomonas aeruginosa (PA)	26

Table S2. Summary of positive patients on each pathogen in qLAMP assays.

Furthermore, clinical diagnostic outcome of pulmonary infection were taken into account. The clinical diagnostic outcomes were considered as a golden standard. We compared the positive rates of qLAMP and culture assays (Table 3). Objectively, culture assays achieved higher positive rate compared to qLAMP assays in the patients with diagnosis of pulmonary infection. The number of positives and negatives of 71 pulmonary infected (or 507 non-pulmonary infected patients) detected by qLAMP or culture assays were shown in Figure 2.

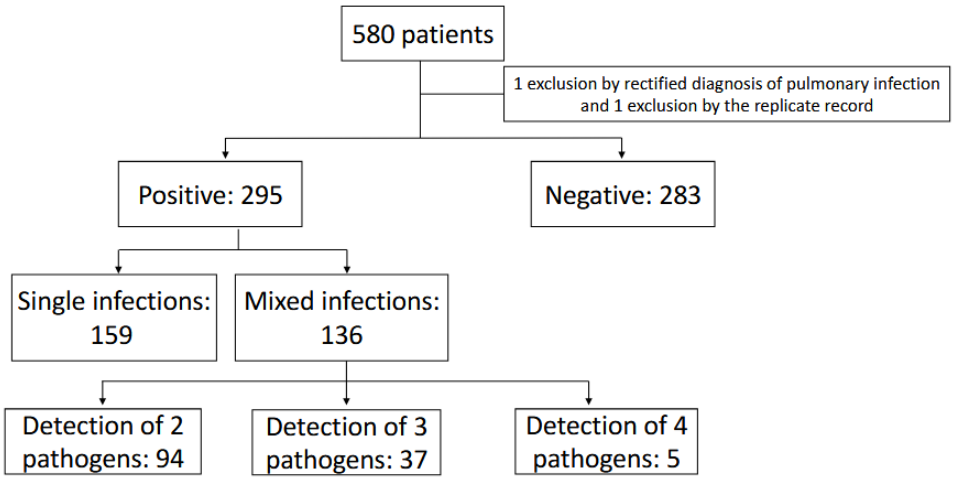

Figure 1

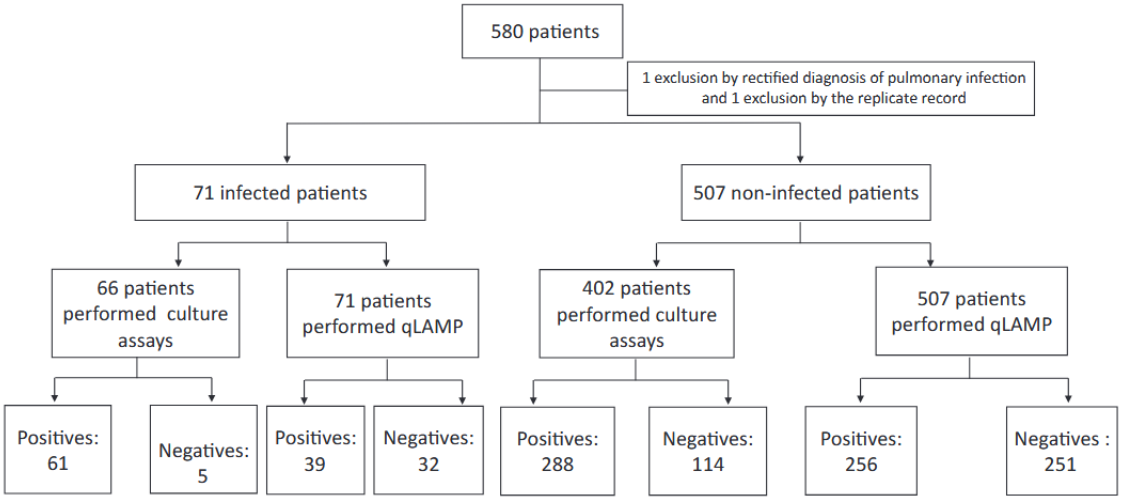

Figure 2

Case Number	Age	Gender
S06995	74	Male
S02417	66	Female
S07398	72	Male
R28536	62	Male
S06963	64	Male
T90906	62	Male
S07621	68	Male
S07430	62	Male
S07823	72	Male
S07562	60	Male
S07836	67	Male
S06860	61	Male
S07407	66	Male
S07900	66	Male
S07572	70	Male
S08029	64	Male
S07930	64	Male
S08375	63	Female
S08274	59	Male
T23620	67	Male
S08081	73	Male
S08272	58	Female
S08135	71	Female

T47400	72	Male
S08462	66	Female
S08554	72	Male
S08509	68	Female
S08562	64	Female
S08319	63	Male
S08851	68	Male
S08303	63	Female
S08474	65	Female
S08943	69	Male
R75753	62	Female
S08299	63	Male
R99018	61	Male
S09152	69	Male
S08841	54	Male
S08610	68	Female
S08912	69	Male
S08705	72	Male
S06192	63	Male
R87777	64	Male
S09081	63	Male
S09126	56	Male
S09074	71	Male
S09491	64	Male
S09373	67	Male
S08370	73	Female
S09571	63	Female
S09578	65	Male
S09707	65	Female
S09762	61	Male
S09510	63	Male
S08654	68	Male
T28907	70	Male
S10147	67	Male
S10064	67	Female
S10081	68	Male
S10059	67	Male
S10185	60	Male
S09130	79	Male
S09944	78	Male
T08804	67	Female
S10177	67	Male
S10599	66	Female
S10346	64	Male
S10741	73	Male
S10154	66	Male
S10886	68	Female
S10690	68	Male
S10673	58	Male
S10715	57	Male
S10914	69	Male
S10647	70	Female
S10539	55	Male
S10298	66	Female
S10971	67	Male
S10967	70	Female
S10889	60	Male
S11110	72	Female
R97612	61	Male
S10972	72	Male
S11102	75	Female
S10839	59	Female
S11277	68	Male

T70922	67	Male
S11415	59	Male
S11443	66	Male
S11155	72	Male
S11495	65	Female
S11242	58	Male
S11604	74	Female
T14361	74	Male
S11308	71	Female
S11608	48	Male
S11799	65	Male
S11408	70	Male
S11233	79	Female
S11710	78	Male
S11609	61	Male
S11675	74	Male
S11922	37	Male
S11702	69	Male
S11453	79	Male
S11287	69	Male
S11830	72	Female
S03999	65	Female
S11996	67	Male
S12165	80	Male
S11852	74	Male
S11903	73	Male
S12196	61	Male
S12090	54	Male
S11872	74	Female
S12030	39	Male
S11945	72	Female
R07653	65	Male
S11948	76	Male
S11651	64	Male
S11615	77	Male
R31179	44	Male
S12041	64	Male
S12437	60	Male
S11575	74	Female
S12358	65	Male
S11562	51	Male
S12232	64	Female
R35378	66	Female
S12494	78	Male
S12510	74	Female
S12394	63	Female
S12612	80	Female
S11784	65	Male
S12317	69	Male
S12279	72	Male
S12611	75	Male
S12685	76	Male
S12462	42	Male
T01667	69	Male
S12132	70	Male
S12794	71	Male
S12507	66	Male
S12617	69	Female
T34652	61	Male
S11753	55	Male
S08908	66	Male
S12692	57	Male
S12561	71	Male

T28119	64	Male
S13040	64	Male
S12900	79	Male
S12643	68	Male
T63815	58	Male
S12497	71	Male
S12942	61	Female
S12968	50	Male
T62020	72	Female
S13070	64	Male
T92235	62	Female
S13388	69	Male
S12899	72	Male
S13161	60	Male
S13374	66	Male
S13075	70	Female
S13483	70	Female
S13119	76	Male
S12818	55	Female
S13092	34	Male
S13116	76	Male
T69123	59	Male
S13544	59	Male
S12985	67	Male
S13363	70	Male
S13329	70	Male
S13704	62	Male
S13510	70	Male
S13570	72	Male
S13872	63	Female
S13273	71	Female
S05757	69	Female
S13659	65	Male
S13676	67	Male
S14002	66	Male
S14040	68	Male
S13029	68	Male
S13792	61	Male
S13779	63	Male
S13982	65	Male
S14223	69	Male
S14203	69	Female
S14020	76	Male
R06923	66	Male
S13834	59	Male
S14102	70	Female
S13803	69	Female
S14373	50	Male
S14226	50	Female
S14319	72	Male
S13727	75	Male
S14268	60	Male
S14089	75	Female
S14362	68	Male
S13969	76	Male
S14228	65	Male
S14110	68	Female
S14399	68	Male
T49805	68	Female
S14177	62	Male
S13808	67	Male
R80255	65	Male
S14389	60	Male

S14141	67	Female
S14505	62	Male
S14424	63	Female
S14607	63	Male
S14508	59	Male
S14555	68	Male
S14702	66	Female
S14483	53	Male
S14604	56	Female
S14597	59	Male
S13702	71	Male
S14614	69	Female
S14592	70	Female
S14696	70	Male
S15036	66	Male
S11668	55	Male
S15169	71	Female
S14788	47	Male
S15151	79	Female
T58694	62	Male
S09301	51	Male
S15077	56	Female
S14713	60	Female
S15070	66	Female
S15008	68	Male
S13589	61	Male
S15329	67	Male
S15104	60	Male
R56879	66	Female
S15090	64	Male
S15354	64	Male
S15360	72	Male
S15485	62	Male
S15538	60	Male
S15275	80	Male
S15126	66	Male
S15314	46	Male
S15017	81	Male
S15669	67	Male
S15440	66	Male
S15529	65	Male
S15306	73	Female
S15819	72	Male
S15666	57	Male
S15148	68	Female
S15441	67	Male
S15456	61	Male
S15771	86	Male
S15316	61	Male
S15755	50	Male
S15699	63	Male
S15601	61	Male
S15823	58	Male
S16032	77	Male
S15617	68	Male
S14768	63	Male
S11938	66	Male
S15999	63	Male
S16143	44	Male
S15887	54	Male
S15214	78	Female
S15908	64	Male
S11209	61	Female

S16159	70	Male
S15806	63	Male
S15844	51	Male
S16079	70	Male
S16389	65	Male
S14648	62	Male
S16485	69	Male
S16308	56	Female
S16331	66	Female
S16459	73	Male
S16299	48	Male
S14589	74	Male
S16373	66	Male
S16633	55	Male
T43883	74	Female
S16537	69	Male
S16193	47	Male
S15575	59	Male
S16100	65	Male
S16960	64	Male
S16877	54	Female
T08864	63	Male
S16466	72	Female
S16880	77	Female
S16830	48	Male
S16749	75	Male
S17000	76	Female
S16839	62	Male
S16799	73	Male
S17308	67	Female
S14561	67	Female
S16929	67	Female
S16375	61	Male
S17112	70	Male
S17088	72	Male
S17320	72	Male
S17172	42	Male
S17122	58	Female
S17307	64	Male
S17322	62	Male
S17306	68	Female
S17331	58	Male
S17381	53	Female
S17156	69	Male
S17593	75	Male
S17528	64	Male
S17434	67	Male
S17577	53	Male
S17727	69	Male
S17144	69	Female
S16719	75	Male
S17848	76	Male
S17820	68	Female
S18180	73	Male
T01274	76	Female
S18030	60	Female
S17445	43	Male
S18057	47	Male
S17857	60	Male
S17835	72	Male
S17969	69	Female
S17713	71	Male
S17984	59	Male

S18075	57	Male
S18074	57	Male
S18108	62	Male
R00118	78	Male
S16576	67	Male
S18221	62	Male
S18118	65	Male
S18330	58	Female
S18684	60	Male
R04519	64	Male
S18286	75	Male
S18639	73	Male
S18183	71	Male
S18492	62	Male
S18425	47	Male
S18498	71	Female
S18336	76	Male
S18839	71	Male
T72067	68	Female
S18395	65	Male
S18721	67	Male
S18627	64	Male
S18870	69	Male
S18914	64	Male
S18755	67	Male
S18928	72	Male
S18744	64	Female
S18480	66	Male
S19102	65	Female
T05927	70	Male
S03099	59	Male
S02851	64	Male
S03371	54	Male
T79395	55	Male
S02147	66	Male
S02870	56	Male
S03260	61	Female
S02629	76	Male
S04052	65	Female
R83711	75	Female
R98520	79	Male
S03740	61	Male
S03960	60	Male
T80952	67	Male
S03881	65	Male
S03888	68	Male
S03893	72	Male
R00627	76	Male
S04428	68	Male
R47647	64	Male
S04746	65	Male
S03978	63	Male
S03264	77	Female
S04239	60	Female
S04163	61	Male
S03938	65	Female
T99379	72	Female
T10451	61	Male
S04341	76	Male
S04285	67	Male
S04401	66	Male
S02155	68	Male
S04559	66	Male

S03747	59	Female
T27933	64	Female
T68966	76	Female
S04439	67	Male
S05279	70	Female
S05132	65	Female
S04993	62	Female
S04452	68	Male
S05198	77	Male
S05111	73	Male
S04445	75	Male
S05543	75	Female
S05321	67	Male
S04816	63	Male
S05178	62	Male
S05536	67	Male
S05168	60	Male
S05449	56	Male
S05283	64	Male
S05196	68	Male
S05018	57	Male
S05930	74	Female
S05895	66	Male
S05638	58	Male
S05248	57	Male
S05917	52	Male
S05907	75	Male
S05902	67	Male
S05791	76	Male
S06028	55	Female
S02607	61	Male
T14192	44	Male
R25239	63	Male
S06141	69	Male
S03497	70	Female
S06522	63	Male
T32051	71	Male
S05954	52	Male
S05982	78	Female
R60882	61	Male
S06226	64	Male
S06158	67	Male
S06398	75	Male
S06083	78	Male
S06357	66	Male
S06416	67	Male
S06495	63	Male
R60755	68	Female
S06264	73	Female
S06621	65	Female
S06703	67	Male
S06455	64	Male
S06702	65	Female
S06695	71	Male
S06795	68	Male
T30067	69	Male
S06829	65	Male
S06822	76	Male
S07014	56	Male
S06836	59	Female
S07135	70	Male
S06813	61	Female
S07263	53	Male

S13054	76	Male
S17350	69	Male
S17821	62	Female
S18386	63	Female
S18880	66	Male
S03621	61	Female
S03642	74	Male
S03749	72	Male

Table S3. Patients performed qLAMP and culture assays

Demographic and clinical characteristics of qLAMP-detected pulmonary infection comparing with non-pulmonary infection

Demographic and clinical characteristics of the patients with and without pulmonary infection according to qLAMP assays were shown in Table . Considering the pathogen panel (LP, MP, CP, SP, SA, EC, KP, PA, AB, SM, HI) of qLAMP assays, we analyzed and compared the characteristics or difference between 263 patients with postoperative pulmonary infections (at least one of the eight species in the pathogen panel of qLAMP were detected) and 280 patients without postoperative pulmonary infections (none of the eight species in the pathogen panel of qLAMP were detected).

The statistics analysis involved clinical information and measurements of patients, including age, gender, smoking index, preoperative cardiac function, preoperative oxygenation index, combined basic diseases (pulmonary disease, diabetes), and postoperative tissue oxygen saturation (left SctO2, SmtO2 left forearm measurement).

The results shows significant differences between two groups on age, smoking index, postoperative tissue oxygen saturation (left SctO2 and SmtO2 left forearm measurement).

Demographic and clinical characteristics of clinical diagnosis of pulmonary infection comparing with non-pulmonary infection

Demographic and clinical characteristics of the patients with and without postoperative pulmonary infection are shown in Table 5. We firstly analyzed and compared the characteristics or difference between 473 patients with postoperative pulmonary infection and 70 patients without postoperative pulmonary infection. The statistics analysis involved clinical information and measurements of patients, including age, gender, smoking index, preoperative cardiac function, preoperative oxygenation index, and combined basic diseases (pulmonary disease, diabetes).

There is no significant difference ($P>0.05$) in the characteristics of the patients between the two groups, including gender, complications, smoking, average cardiac output CO, preoperative oxygen, underlying disease (lung disease and diabetes), and postoperative complications. Only moderate significant difference ($P=0.05$) between group with age >60 and with age ≤60, indicating the pulmonary infections may present the preference of the elder population.

Conclusion

Here, we report that culture and qLAMP methods were used to identify the potential pathogens that can cause complication in pneumonia. The results show that qLAMP can rapidly and effectively detect pulmonary pathogens and is a rapid diagnostic tool. The authors analyzed clinical characteristics of the patients based on qLAMP results and found associations between age, smoking index, and postoperative tissue oxygen saturation with the occurrence of pulmonary infections.

Discussion

Postoperative pulmonary infection in patients with coronary atherosclerosis affects the mortality rate, and the correct use of antibiotics can effectively alleviate it, so the detection of pathogens is particularly important. Although culture method is the gold standard for identifying bacteria and fungi, it can lead to delays in targeted antibiotic therapy because bacterial cultures often fail to return useful results in a timely manner. qLAMP has advantages in guiding targeted antibiotic therapy for pulmonary infections.

In recent years, loop-mediated isothermal amplification (LAMP) has become increasingly popular, and qLAMP methods are rapid and cost-effective [14]. Because it can operate at a constant temperature, it overcomes the need for expensive instruments such as thermal cyclers [15]. In addition, qLAMP assays excel in terms of time efficiency [14] and can enable healthcare providers to obtain the necessary results in a timely manner to make timely decisions. Therefore, qLAMP can be used as a potential tool for postoperative pulmonary infection screening.

In order to evaluate the value of qLAMP in detecting pulmonary infection, qLAMP was utilized to detect pathogens. Then the congruence between qLAMP and culture method was compared. Among the detected pathogens, the concordance rate of KP was as high as 86.0%, demonstrating the potential of qLAMP for pathogen detection in pulmonary infection. Next, a comparative analysis of qLAMP tests revealed significant differences in age, smoking index, and postoperative tissue oxygen saturation between patients with and without pulmonary infection. Finally, based on clinical diagnostic outcome, it revealed that pulmonary infection may be a preference in the elderly population. The results of the comparative analysis characterize a wealth of demographic and clinical characteristics.

Although quantitative LAMP (qLAMP) is more expensive than routine bacterial culture, the gross cost of the test is easily compensated by its ability to inform more accurate and timely etiological diagnosis. Due to culture-based assays detecting all living bacterial cells, qLAMP takes advantages over rapid and timely detection of representative pathogens in pulmonary infection.

Inevitably, there are a few limitations in our studies. Firstly, in patients diagnosed with pulmonary infection, the positive rate of culture assay is higher than qLAMP. That indicated that qLAMP should be combined with the culture assasy, rather completely replacing culture assay. Secondly, this study was conducted with a small sample size, and the presence of random effects to some extent affects the conclusions. These limitations provide a novel direction for the research of qLAMP assays.

Here, we used qLAMP assay to quantify the pathogen in samples, then compared the results with culture method. We evaluated the feasibility of qLAMP for postoperative pulmonary infection and revealed the demographic and clinical characteristics of patients with pulmonary infection.

Ethics statement

The study was approved by and carried out under the guidelines of the Ethical Committee of Tianjin Chest Hospital, China. All patients provided written informed consent for the collection of samples and subsequent analysis. The sputum specimens were collected between Dec 2021 and July 2022.

Author contributions

Chang Xie: Data curation, Formal Analysis, Writing original draft; Zhenhua Wu: Data curation, Formal Analysis, Writing original draft; Jie Li: Data curation, Investigation, Formal Analysis; Siyao Dong: Data curation; Yonghong Ren: Formal Analysis; Fanlin Meng : Writing review & editing.

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